CENTRAL ARTERY/TUNNEL PROJECT

FHWA-MA-EIS-82-02-FS3
EOEA #4325

CHARLES RIVER CROSSING

Final SUPPLEMENTAL

ENVIRONMENTAL IMPACT STATEMENT/REPORT

Existing Charles River Crossing Area – Boston, Massachusetts

Part I

Federal Highway Administration
Massachusetts Highway Department

December 1993

FHWA-MA-EIS-82-02-FS3

Charles River Crossing

CENTRAL ARTERY/TUNNEL PROJECT
BOSTON, MASSACHUSETTS

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/REPORT

Submitted Pursuant to 42 U.S.C. 4332(2) (C)
(and where applicable, 49 U.S.C. 303)
by the
U.S. Department of Transportation, Federal Highway Administration
and
Massachusetts Highway Department

Cooperating Agencies

- U.S. Advisory Council on Historic Preservation
- U.S. Army Corps of Engineers
- .S. Coast Guard
- U.S. Department of the Interior
  - Fish and Wildlife Service
  - National Park Service
  - Geological Survey
- U.S. Environmental Protection Agency
- Federal Aviation Administration
- Federal Transit Administration
- National Marine Fisheries Service
- Massachusetts Bay Transportation Authority
- Massachusetts Port Authority
- Massachusetts Turnpike Authority
- Massachusetts Aeronautics Commission
- Massachusetts Water Resources Authority
- Massachusetts Historical Commission
- Massachusetts Executive Office of Environmental Affairs
  - Department of Environmental Management
  - Department of Environmental Protection
  - Metropolitan District Commission
  - Dept. of Fisheries, Wildlife, and Env. Enforcement
  - Division of Marine Fisheries
  - Coastal Zone Management
- Metropolitan Area Planning Council
- City of Boston
  - Boston Conservation Commission
  - Boston Water and Sewer Commission
- City of Cambridge
  - Cambridge Conservation Commission
- City of Somerville

1.24.94
Date of Approval

For EOTC

1/24/94
Date of Approval

Peter M. Zuk
For MHD

2/2/94
ate of Approval

Stephen A Moreno
For FHWA

This is a Supplement to FHWA-MA-EIS-82-02-F and EOEA No. 4325. This Supplement describes the Charles River Crossing portion of the Central Artery/Tunnel Project and its impacts on the Area North of Causeway Street Project subarea.

CENTRAL ARTERY/TUNNEL PROJECT

FHWA-MA-EIS-82-02-FS3
EOEA #4325

CHARLES RIVER CROSSING

Final SUPPLEMENTAL

Part I

Federal Highway Administration
Massachusetts Highway Department

MASS HIGHWAY

December 1993

CENTRAL ARTERY/TUNNEL PROJECT

BOSTON, MASSACHUSETTS

CHARLES RIVER CROSSING

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/REPORT

FHWA - MA - EIS - 82 - 02 - FS3

EOEA #4325

Submitted by the Massachusetts Highway Department

Prepared by Bechtel/Parsons Brinckerhoff

December 1993

This is a Supplement to FHWA-MA-EIS-82-02-FS2 and EOEA #4325. This Supplement describes the Charles River Crossing portion of the Central Artery/Tunnel Project and its impacts on the Area North of Causeway Street.

Summary

EXECUTIVE SUMMARY

Charles River Crossing
Final Supplemental Environmental Impact Statement/Report
Final Section 4(f) Evaluation

• Introduction

The Massachusetts Highway Department (MHD) and the Federal Highway Administration (FHWA) have prepared this Final Supplemental Environmental Impact Statement/Report (FSEIS/R) for the Charles River Crossing in the Area North of Causeway Street subarea of the Central Artery/Tunnel Project (the Project) in Boston and Cambridge. The Final Section 4(f) Evaluation is published at the end of Part I of the FSEIS/R.

The 1993 DSEIS/R considered the impacts of Scheme Z as weighed against three new design alternatives: Alternative 8.1D Mod 5, which resulted from the Bridge Design Review Committee (BDRC) process and which was the subject of the Notice of Project Change (NPC) of September 1992; and two alternatives of that design, the Reduced River-Tunnel and Non-River-Tunnel Alternatives. All three new designs were developed with the goal of minimizing the aesthetic and environmental effects of Scheme Z, while maximizing traffic operational efficiency and maintaining appropriate levels of safety.

This FSEIS/R describes the environmental, aesthetic, and construction impacts of the Preferred Alternative, and compares them to the impacts of Scheme Z, the Proposed Action of the 1991 Projectwide FSEIS/R. The Preferred Alternative is based on the Non-River-Tunnel Alternative as presented in the 1993 Charles River Crossing DSEIS/R, with refinements added since publication of the latter document.

• Major Policy Issues Affecting The Charles River Crossing

Since no alternative presented in the 1993 DSEIS/R demonstrates clear superiority in all transportation and environmental categories, a balancing of interests is needed to arrive at a preferred alternative. As noted by the Secretary of the Massachusetts Executive Office of Environmental Affairs (EOEA) in the Massachusetts Environmental Policy Act (MEPA) Certificate on the 1993 DSEIS/R, the environmental impacts of the three new design alternatives are "the same or similarly significant"; they will not be the determining factor in such a selection. The Certificate and responses to it are located at the end of this summary.

The Charles River Crossing is needed to link regional highway facilities on the south side of the river, including components of the Central Artery/Tunnel Project in Boston, to the regional network on the north side of the river, and to complete all necessary local connections to these facilities.

The Preferred Alternative described in this FSEIS/R is intended to reduce the environmental and aesthetic impacts of Scheme Z, while increasing its level of improvement in traffic operations and safety. Scheme Z provided acceptable traffic operations for the Project. It was approved in concept during the 1991 environmental review process that followed the publication of the 1991 FSEIS/R. The then Secretary of EOEA, however, requested further study of the Charles River Crossing portion of the Project in order to review ways to minimize the aesthetic and environmental impacts of the design. A 2-year design review effort ensued involving the BDRC, with over 40 representatives of local and professional design interests. An extensive environmental review process followed, beginning with the NPC. In November 1993, the Secretary of the Executive Office of Transportation and Construction (EOTC) identified the Preferred Alternative to be evaluated in this FSEIS/R.

A number of criteria were used as the basis of selection of the Preferred Alternative over Scheme Z and the other two designs evaluated in the 1993 DSEIS/R. Overall, the criteria recognize the goals and objectives of MHD, FHWA, and the U.S. Army Corps of Engineers (USACE) to construct a Crossing that causes the least environmental damage, yet maximizes the Project goal of increased traffic efficiency and safety. These criteria also incorporate the goals of maximizing parkland potential supported by EOEA and the Metropolitan District Commission (MDC), which is the regional park agency with jurisdiction in the Charles River area. Moreover, these criteria achieve the goals of the BDRC with regard to improving bridge aesthetics and the open space environment in the Charles River Crossing area.

Traffic Operations And Safety. Efficient traffic flow and safety are primary Project objectives. The Preferred Alternative fulfills the transportation objectives and improves on the efficiency of Scheme Z. The inclusion of land-based tunnels in the North Station area provides direct access between the Central Artery and the Leverett Circle/Storrow Drive area, eliminates the double crossing of the Charles River, reduces traffic volume on local streets, and decreases the total number of vehicle miles travelled. The inclusion of a high-occupancy vehicle (HOV) lane on I-93 southbound encourages efficient use of the regional highway system. A downtown on-ramp to I-93 northbound is included in the Preferred Alternative, which was not in Scheme Z.

Environment And Aesthetics. A major focus in design development has been the reduction in the mass of Scheme Z's loop ramps, and their relocation away from the riverbank. On the north bank of the river, Scheme Z has six loop ramps rising to high elevations and close to the river's edge. The Preferred Alternative reduces this mass to three then two loop ramps, which are much lower in height, and farther away from the riverbank. In addition, the number of bridge structures is reduced from three bridges to two. The double-deck bridge of Scheme Z is replaced by a single-deck bridge. The profiles of the two bridges are similar, reducing visual impact. Overall the Preferred Alternative minimizes impacts of the Crossing on parklands, aquatic and historic resources, and surrounding communities.

Cost. The cost of the Charles River Crossing was not a factor in evaluating the environmental impacts of the alternatives. Fiscal responsibility was considered in identification of the Preferred Alternative once the environmental impacts of the alternatives, as analyzed and documented in the environmental review process to date, proved to be substantially equivalent.

• Approach Of This FSEIS/R

This FSEIS/R compares the impacts of the Preferred Alternative, selected following a broad-based analysis of the four designs compared in the 1993 DSEIS/R, with the impacts of Scheme Z, the Proposed Action of the 1991 FSEIS/R. A summary analysis and comparison of the four designs and refinements is presented in Chapter 2; the remainder of the document focuses on the Preferred Alternative and Scheme Z.

Chapter 2 describes the selection process for the Preferred Alternative. It identifies the goals and objectives that were used in selecting the Preferred Alternative, and includes a review of the Project's transportation, environmental, and aesthetic objectives for the Charles River Crossing design. Also described are the goals and objectives identified by the BDRC which were incorporated into the Project's overall goals and objectives. The selection of the Preferred Alternative resulted from a comparison of the impacts of Scheme Z and the three alternative designs for the Charles River Crossing in relation to these established goals and objectives. As noted in the MEPA Certificate of October 15, 1993, on the DSEIS/R, and confirmed by the results of the above-referenced comparison of impacts, there was no obvious choice among the four designs based upon comparing environmental impacts alone. The reasons why the Preferred Alternative was selected are set out (best balance among the various considerations), as well as the features and impacts of each of the design alternatives (and refinements) that were not selected.

• Summary Description Of The Preferred Alternative And Scheme Z

Preferred Alternative. The Preferred Alternative includes two land-based tunnels beneath the North Station area which provide connections between I-93 south of the Charles River and Storrow Drive. The inclusion of these tunnels allows for the elimination of the "double crossing" of the Charles River required by Scheme Z. There are three loop ramps merging to two in East Cambridge, and a total of 14 lanes of traffic crossing the Charles River. The mainline bridge is proposed as a 10-lane cable-stayed structure with a diamond-shaped tower on either side of the river. The mainline bridge features four lanes in each direction and an additional two lanes on its eastern side to carry downtown Boston and Sumner Tunnel traffic to I-93 northbound. A second bridge, with a profile similar to the mainline structure, carries an additional four lanes (two in each direction) to and from Storrow Drive/Leverett Circle. A total of 3,300 linear feet (lf) of highway are in land-based tunnels in the North Station area. A ventilation building, necessary to service the tunnels, is situated on the south side of the Charles

River and constructed below ground behind North Station east of Nashua Street, with ventilation and exhaust-air stacks built above ground.

Several refinements have been incorporated into the design since the DSEIS/R. There is no resulting change in alignment, but some of these changes involve important reductions in the impacts of the Preferred Alternative. One, the realignment of the Nashua Street off-ramp (Ramp CN-L), results in the relocation of the ventilation building farther south, adjacent to the viaduct ramps and Storrow Drive connector. The realignment of the City Square off-ramp (Ramp C-L) to the Sullivan Square area avoids previously described impacts to the athletic facilities at Bunker Hill Community College. The realignment of Nashua Street avoids affecting a residential building in the Lowell Square area. Finally, the design of the I-93 collector/distributor as a single-deck structure simplifies and improves the roadway design.

Scheme Z. Scheme Z features three bridge structures: two cable-stayed bridges with a tower on each side of the Charles River, and a double-deck bridge differing in type and profile from the main bridge. There are no tunnels and no ventilation building in this Project subarea. The two cable-stayed bridges, each with five lanes of traffic in one direction, accommodate the I-93 mainline, while the double-deck bridge (three lanes over three) accommodates traffic to/from Leverett Circle/Storrow Drive, for a total of 16 lanes over the river. Viaduct structures in East Cambridge provide connections to Storrow Drive and Charlestown. Some traffic movements (I-93 northbound to Storrow Drive, and Storrow Drive to I-93 southbound) require motorists to cross the river twice. The dominant features of this design are the large bridge structures which have inconsistent profiles and six loop ramps in East Cambridge.

- **Summary Of Environmental Impacts**

Traffic And Transportation. The Preferred Alternative improves traffic operations over those of Scheme Z. It shifts daily traffic volumes to the expressway system and away from local and arterial streets. There are two major reasons for this:

- elimination of the need for double crossings of the Charles River, which increases the capacity of I-93 and allows it to be used more efficiently
- inclusion of a new northbound on-ramp in the upper downtown area, making I-93 more accessible

As a result, traffic volumes are lower with the Preferred Alternative than Scheme Z at a number of key intersections: Keany Square, City Square, and Sumner Tunnel/North Washington Street. The Preferred Alternative further reduces traffic volume and improves operations in City Square because of the relocation of Scheme Z's City Square off-ramp (Ramp C-L) to Cambridge Street near Sullivan Square in northern Charlestown. Nine intersections operate at level of service (LOS) F in the PM peak hour with the Preferred Alternative compared to ten with Scheme Z. In the AM peak hour, 13 intersections operate at LOS F with the Preferred Alternative and 14 with Scheme Z. The air quality performance in aggregate at these intersections is slightly better for the Preferred Alternative than for Scheme Z.

Traffic conditions on the I-93 mainline are similar overall for the Preferred Alternative and Scheme Z. Variations occur in different parts of the mainline and at different times of day.

The Preferred Alternative includes an HOV lane on the I-93 southbound mainline which is not included in Scheme Z, which has an HOV facility on the Nashua Street off-ramp only. The advantage for HOVs relative to general-purpose traffic is greater with the Preferred Alternative.

No permanent impacts on commuter railroad service are anticipated. Some impacts during construction on light rail (i.e., the Green Line) are foreseen, and are being coordinated with the Massachusetts Bay Transportation Authority (MBTA). The Preferred Alternative does not impede the development of a future rail link between North and South Stations.

Existing hazardous cargo routes within the Project limits are not affected. The 1993 DSEIS/R cited the discussion between MHD and the Boston Fire Department (BFD) concerning the possibility of use by hazardous cargo vehicles of the tunnels being constructed as part of the CANA project, a separate MHD project. This discussion has since been resolved: CANA tunnels, in compliance with City and State regulations, cannot be used by hazardous cargo vehicles; such vehicles also will be prohibited from all tunnel segments of the Central Artery/Tunnel Project. Adequate alternative routes exist for the transportation of hazardous cargo.

The Preferred Alternative, by eliminating the double river crossing, reduces Projectwide vehicle miles travelled (VMT) by 0.6 percent and vehicle hours travelled (VHT) by 0.9 percent, compared to Scheme Z.

Land Use Including Open Space. Neither the Preferred Alternative nor Scheme Z results in long-term land use pattern changes. Both, however, do affect development opportunities of land on both sides of the river, both result in takings of land and buildings, and both affect existing and planned open space. The major land use impact is on existing and proposed parkland and open space. While expansion of parkland is allowed by both designs, implementation of the MDC parkland master plan concepts is facilitated by the Preferred Alternative. An extensive parkland mitigation program in the New Charles River Basin area has been coordinated with the MDC and the Massachusetts Department of Environmental Protection (DEP) (see Chapter 6, Mitigation).

Parkland impacts including the mitigation program are discussed in the Final Section 4(f) Evaluation summary. Open space impacts are as follows:

North Point Area: In the North Point area, the Preferred Alternative results in a major improvement over Scheme Z in impacts on area development and recreational use of the river.

North Bank Transportation Corridor: In this corridor, which includes the MBTA commuter railroad tracks and bascule bridge and the existing I-93 bridge, the Preferred Alternative is a substantial improvement over Scheme Z, with its loop ramp set farther away from the riverbank, opening the area to a much greater extent, thereby creating less continuous shadow impacts on the Charles River than Scheme Z. The existing I-93 bridge will be removed as part of the new Crossing.

South Bank Transportation Corridor: This area is between Paul Revere Landing Park South and the railroad crossing, and is primarily part of the riverfront path system. The Preferred Alternative offers superior bridge aesthetics over Scheme Z, with more open views and a wider gap between its two bridges compared to Scheme Z.

City Square Park: The Preferred Alternative has a more positive effect than Scheme Z on City Square Park, which is being constructed on land reconfigured by the CANA project. The Preferred Alternative design removes the City Square off-ramp near Sullivan Square in northern Charlestown, reducing traffic in City Square and providing a safer setting and better access to the park.

Other Major Impacts. Other major impacts include the following.

Property Takings: The Preferred Alternative, as proposed, requires more permanent takings than Scheme Z and has greater right-of-way impacts. It involves the acquisition of the Spaulding Rehabilitation Hospital and Boston Thermal Energy Corporation's (BTEC) Minot Station steam generating plant. All efforts will be made to minimize acquisition requirements during the final design process. Scheme Z takes neither. The DSEIS/R stated that the Non-River-Tunnel Alternative (now the Preferred Alternative) required the reconfiguration of athletic fields at Bunker Hill Community College; because of design refinements since the DSEIS/R, the College is no longer affected.

Economic Impacts: The Preferred Alternative will have a more positive impact than Scheme Z. The improved aesthetic impacts on the North Point area facilitate future proposed development. Overall, however, macroeconomic fluctuations in the business cycle have a greater impact on this area than either design.

Joint Development: Five parcels of land have potential for joint development (see Figure 4.19): the Massachusetts General Hospital (MGH) Nashua Street parcel; the Spaulding Hospital site; the air rights garage parcel above the MBTA railroad tracks; the Lomasney Way parcel; and the Rutherford Avenue parcel. In general, both the Preferred Alternative and Scheme Z allow for joint development on all parcels. The Lomasney Way parcel has joint development potentials under either design. Neither design affects the Rutherford Avenue parcel. The taking of the Spaulding Hospital site for the Nashua Street off-ramp expands joint development opportunities. The southern portion is consolidated into the MGH Nashua Street parcel; the northern portion is consolidated into the MDC Nashua Street Park for additional parkland development. The air rights garage, however, is decreased in size by 49 percent with the Preferred Alternative.

Air Quality: The Preferred Alternative represents a slight benefit to air quality as compared to Scheme Z. The regional areawide (mesoscale) analysis for the year 2010 shows decreases in emissions of carbon monoxide (CO) of 0.7 percent, nitrogen oxides (NO_x) of 0.6 percent, volatile organic compounds (VOC) of 0.3 percent, and particulate matter (PM_{10}) of 0.7 percent for the Preferred Alternative as compared to Scheme Z.

The microscale analysis indicates that the Preferred Alternative causes no violations of ambient air quality standards for the years 2001 and 2010. Of the 23 intersections considered, CO concentrations in 2010 are estimated to be better at 13 intersections with the Preferred Alternative than with Scheme Z, because of improved traffic operations on local and arterial streets. Overall impacts of the Preferred Alternative are, in general, less than those of Scheme Z.

The Preferred Alternative has land-based tunnels and one below-grade ventilation building, which Scheme Z does not. No violations of National and State Ambient Air Quality Standards (AAQS) and DEP Policy Guidelines for NO_2 are predicted as a result of emissions from this ventilation building.

Noise And Vibration: Traffic noise impacts were assessed at 20 receptor sites. For both designs, 2010 noise levels approach or exceed FHWA Noise Abatement Criteria (NAC) at 19 out of the 20 sites; three more sites than do existing noise levels. No substantial impacts are expected.

The ventilation building for the Preferred Alternative is built below grade, minimizing noise levels which are within DEP criteria. Scheme Z requires no ventilation building.

Future traffic vibrations are not predicted to reach levels high enough to cause damage to historic or nonhistoric structures, or to adversely affect people inside buildings.

Wetlands: Both the Preferred Alternative and Scheme Z have minimal long-term impacts to Federal and State aquatic resources in the Charles and Millers Rivers due to placement of bridge piers. The Preferred Alternative results in more fill of State and Federal resources for access ramps. Scheme Z affects 70 lf of bank and 0.11 acres of Land Under Water (LUW) in both the Charles and Millers Rivers. The Millers River is, however, a substantially degraded resource area with minimal wetlands functions. All activities in the Charles and Millers Rivers have an insignificant impact to the principal valuable functions of Federal jurisdictional aquatic resources, and the performance standards of the Massachusetts Wetlands Protection Act will be met. Impacts to Federal and State resource areas will be mitigated by the construction of a water feature in the North Point area as part of the New Charles River Basin mitigation program discussed in Chapter 6.

Waterways: The Preferred Alternative results in fewer permanent impacts to filled tidelands and waterways than Scheme Z. This is due to the inclusion of land-based tunnels, which maximizes waterways interests of public access and visual quality. In addition, the amount of viaduct and pier structure is reduced and loop ramps are moved away from the Charles River bank. Parkland with substantially improved public access will result from the mitigation program.

Water Quality: No long-term impacts to water quality are anticipated from either the Preferred Alternative or Scheme Z. Both result in minor temporary increases of turbidity due to construction of bridge piers.

The Preferred Alternative generates less stormwater runoff than Scheme Z since a portion of the roadway is in tunnel; stormwater flows for Scheme Z cause no significant degradation of water quality. In either design, stormwater runoff will be discharged below the Charles River Dam and Locks into Boston Harbor. Tunnel washdown water is discharged to sanitary sewers for treatment.

Navigation: No long-term impacts to navigation in the Charles River are anticipated from the Preferred Alternative or Scheme Z. Some short-term impacts are unavoidable during construction; these will require coordination with the affected marine community and agencies with jurisdiction over navigation.

Fisheries: There are no long-term impacts to fish habitat under either the Preferred Alternative or Scheme Z. Construction period impacts to fisheries will be minimized by avoiding construction activity in the Charles River which could affect fish migration.

Other Aquatic Resources: The Project has minimal long-term impacts on floodplains and wildlife. Both designs are consistent with the Massachusetts Coastal Zone Management program.

Threatened And Endangered Species: No known Federal listed threatened or endangered species are known to use the Area North of Causeway Street.

Historic And Archaeological Resources: The Preferred Alternative requires the underpinning of the Registry building at 100 Nashua Street, a National Register-eligible structure. Generally, the Preferred Alternative does not have adverse long-term impacts that significantly impair the integrity and attributes of historic structures in the affected area. Scheme Z dramatically alters the setting of Tower A, largely obscuring views of it. If new archaeological resources are identified in the I-93 corridor north of the Gilmore Bridge, these may be mitigated by revisions to locations of structural supports for the new adjacent collector/distributor viaduct.

Hazardous Waste Sites: No hazardous waste sites or areas of extensive soil or groundwater contamination have been identified in the Area North of Causeway Street.

Visual Impacts: Visual impacts of the Preferred Alternative's bridges are superior to those of Scheme Z, since it has two bridges of consistent profile, where Scheme Z features three, one of which is a double-deck structure. The Preferred Alternative features three loop ramps which merge to two in East Cambridge--less in number and simpler in design compared to the six loop ramps with Scheme Z; the latter are higher and closer to the riverbank. The loop ramps of the Preferred Alternative are more coordinated with other elements, and visual impacts on the water environment are generally reduced compared to Scheme Z.

Scheme Z passes 55 feet above the Charles River and is supported by 11 piers in the water. The piers visually dominate the river and create a 270-foot-long corridor of shadow, including 65 feet of gaps. Parkland proposed along the river is limited in width and partly in shadow due to the loop ramps. Shadows on parklands are reduced with the Preferred Alternative, and a less cluttered view is provided.

The Preferred Alternative requires one ventilation building on the south side of the river. It will be built primarily below grade with stacks extending above grade.

Energy: The difference in energy requirements of the Preferred Alternative and Scheme Z is negligible.

Construction Staging And Sequencing: The goal of the Project is to stage construction with traffic control plans which maintain existing traffic conditions with as little disruption as possible. All bridge construction requires turbidity controls, and temporarily interferes with navigation. Duration of construction is similar for both the Preferred Alternative and Scheme Z (8.5 years).

Materials Disposal: The total volume of dredged and excavated materials is 494,000 cubic yards (cy) for the Preferred Alternative, and 154,000 cy for Scheme Z. The greater volume for the Preferred Alternative is due largely to the inclusion of land-based tunnels in the design. Excavated materials will be processed into Project backfill or landfill cover or shaping material, or processed for distribution to municipal landfills as cover. Excavated and dredged materials will be disposed of in accordance with applicable regulations.

Short-Term Uses Versus Long-Term Impacts: Both the Preferred Alternative and Scheme Z include measures to mitigate potential short- and long-term adverse impacts. With the above general commitments, the short-term construction impacts are minimized while enhancing the long-term productivity of the environment.

Irreversible And Irretrievable Commitment Of Resources: Implementation of either the Preferred Alternative or Scheme Z involves a permanent and irretrievable commitment of natural, physical, and fiscal resources. A onetime irretrievable expenditure of $995 million for the Preferred Alternative or $489 million for Scheme Z (estimated, based on August 1993 dollars) includes construction and right-of-way acquisition. Substantial amounts of labor and raw materials are required for construction of either design. Permanent takings of land and buildings are higher for the Preferred Alternative than for Scheme Z.

Removal of the existing I-93 piers, for either design, enhances the Charles River. The Preferred Alternative encroaches on the Millers River. That river is, however, considerably degraded and serves little active wetlands functions; and the opportunities for expansion of the Charles River Reservation are greatly enhanced overall, particularly by the Preferred Alternative, which has less viaduct and pier structure than Scheme Z. Shadow impacts are therefore less as well for the Preferred Alternative.

Resolution Of Areas Of Controversy. Areas of controversy identified in the DSEIS/R Summary are now resolved by the selection of the Preferred Alternative, as described in Chapter 2 of this FSEIS/R. The fewer loop ramps in East Cambridge and the proposed bridge structure of the Preferred Alternative represent an appropriate and achievable balance between transportation objectives and aesthetic and environmental interests. Several commenters on the DSEIS/R indicated that these structures are a major improvement over those of Scheme Z. In addition, Bunker Hill Community College athletic facilities are no longer affected since Ramp C-L has been relocated out of the College area to Cambridge Street.

Resolution Of Issues. MHD's responses to issues raised on the 1993 DSEIS/R for the Charles River Crossing are addressed in Chapter 7 and in the responses to comments in the Appendix in Part II of this FSEIS/R.

• Major Actions Proposed By Other Governmental Agencies In The Project Area

MBTA. The MBTA plans to upgrade service at North Station: extension of the railroad tracks and platforms; construction of a new Green/Orange Line superstation below grade, replacing the Green Line now on viaduct; and construction of an underground parking behind the Boston Garden. The MBTA also plans to relocate the Green Line Lechmere station and reconstruct the Science Park station.

MDC. The MDC seeks to develop continuous open space along the north and south banks of the Charles River between the Esplanade and Boston Harbor. The MDC parkland master plan includes a new park between Nashua Street and the river, a new park on the Cambridge side, and extensions of pedestrian and bicycle paths.

Cambridge Community Development Department. Plans for the North Point area redevelopment for mixed residential/commercial use have been reviewed and approved by the Cambridge Community Development Department.

North Station/South Station Rail Link. The Massachusetts EOTC and the Federal Transit Authority are investigating the feasibility of constructing a continuous rail link through central Boston, including through the Area North of Causeway Street. The new underground link would provide through service that now terminates at each railroad station. The Preferred Alternative accommodates the rail link and allows for the most flexibility for future rail link design.

• Other Federal Actions Required For Implementation Of Proposed Action

USACE.

- Section 10 Permit, for construction and dredging in navigable waters
- Section 103 Permit (Marine Protection, Research, and Sanctuaries Act) for ocean disposal of dredged material
- Section 401 Water Quality Certification (U.S. Clean Water Act), administered by the Massachusetts DEP, Division of Water Pollution Control
- Section 404 Permit for discharge or dredged or fill material in water of the U.S.

Department Of Interior.

- Section 106 (National Historic Preservation Act of 1966 review

EPA.

- National Pollution Discharge Elimination System Permit

Federal Aviation Administration.

- Federal Aviation Regulations, Parts 77, 151, and 152

Coast Guard.

- Permits for new bridges over navigable waters
- Permits for alterations of existing bridges

SUMMARY OF FINAL SECTION 4(f) EVALUATION

- **Parklands**

Leverett Circle/Storrow Drive (Charles River Esplanade): With both the Preferred Alternative and Scheme Z, Leverett Circle is reconfigured. With the Preferred Alternative, a small area is changed from roadway landscaping to pavement (a net decrease of 0.33 acre), and an adjacent area from pavement to landscaping (a net increase of 0.15 acre). Scheme Z has similar impacts, but with a net decrease of 0.3 acre of landscaping and net increase of 0.27 acre.

Charles River Basin Extension Recreation Area: This water recreation area is between the old dam and the MBTA bridge. The Preferred Alternative reduces the visual impacts of Scheme Z through reduction of the number and height of loop ramps on the north bank of the Charles River. Noise impacts are reduced through greater setbacks with the Preferred Alternative.

Nashua Street/Spaulding Walkway: This area is planned for passive uses. The Preferred Alternative substantially improves the quality of the area, compared to Scheme Z. With the latter design, the area is dominated by views and noise of six densely nested loop ramps, rising 105 feet in height, across the river.

Parkland At The Former GSA Site: The MDC proposes a park at this location. The Preferred Alternative substantially reduces the visual impacts on the park site present with Scheme Z.

Paul Revere Landing Park North: This area will be expanded upstream as a mitigation measure of the Project, including the removal of the ramp stubs constructed under the CANA project. It is envisioned as a major passive use area oriented to the river and the locks. The Preferred Alternative has visual and noise impacts on the park, but does allow further expansion, compared to Scheme Z.

Charles River Dam Walkway: Both the Preferred Alternative and Scheme Z improve the setting of the Charles River Dam walkway by removing the existing I-93 bridge and replacing it with a new bridge farther upstream.

Paul Revere Landing Park South: The Preferred Alternative allows the successful implementation of the planned functions and uses of the MDC master plan, i.e., an entry area for the riverfront park system pedestrian connections, and passive uses oriented to the river and the locks. The Preferred Alternative also offers substantially improved bridge aesthetics over Scheme Z, which benefits future park users.

Bunker Hill Community College Athletic Facilities: A new refinement of the Preferred Alternative removes the northbound off-ramp to Rutherford Avenue from the College's fields, so that they are no longer affected.

- **Historic Resources**

Charles River Basin District: Reconfiguration of Leverett Circle minimally changes the definition of this historic district, but does not affect contributing features of the district.

Granite Seawalls In The Lower Basin Of The Charles River: Both designs require reconstruction of portions of seawall. In both instances, the seawalls would be dismantled and replaced in kind. In addition, the New Charles River Basin mitigation program removes a small section of the seawall.

Tower A: The Preferred Alternative avoids any permanent use of the railroad building. Scheme Z dramatically alters the setting, largely obscuring views of it.

100 Nashua Street (Registry Of Motor Vehicles): The Preferred Alternative has a southbound tunnel under the building, requiring underpinning before construction. Scheme Z does not affect this resource.

NEW CHARLES RIVER BASIN MITIGATION PROGRAM

As a result of Project impacts on waterways, wetlands, and 4(f) resources, an extensive mitigation program has been incorporated into the Project. The program in the area of the Charles River Crossing is based on the concepts of the MDC's New Charles River Basin Master Plan. The goal of the program is to match the quality of the existing MDC Esplanade upstream of the old Charles River Dam.

The MDC master plan seeks to complete the connection of the Esplanade to Boston Harbor, with a continuous system of landscaped areas and pedestrian walkways. The parkland measures will include new water features to compensate for direct Project impacts to existing waterways and wetlands. Upgrading of historic MDC facilities are included in the program. The schedule for the MDC's master plan is dependent on the Project schedule. The Secretary of Environmental Affairs has directed that the mitigation measures be implemented as early as possible. According to a conceptual implementation schedule, several measures are to be implemented prior to mainline construction, others during construction as certain Project components are completed. Features of the program include the following existing and new parcels. Acreages where given are approximate; landscaping, lighting, and park furnishings will be appropriate to each parcel.

Paul Revere Landing Park South: This 2.1-acre area will be improved as a major entrance to the Basin, with intersecting pathways connecting with a pedestrian bridge over the MBTA railroad tracks.

Lovejoy Wharf Park: Lovejoy Wharf has an area of 0.8 acre and is adjacent to Paul Revere Landing Park South. It will include a path linking it to the North Washington Street bridge and to the North End Waterfront Park.

Leverett Circle/Storrow Drive: Landscaping of 0.9 acre, and architectural treatment of the new underpass facade will be provided. An extension to the new Nashua Street Park will be included in the program to replace the existing pedestrian overpasses.

Paul Revere Landing Park North: Expansion of this park to 4.6 acres and relandscaping will provide a gateway to the new park system from Charlestown. Pathways will provide connections to other park areas.

Paul Revere Landing Park North, Westerly Extension, Including Millers River Area: This new parkland area of 6.0 acres will extend west along the riverbank, with walkways connecting to other parklands and roadway facilities. Also included is pedestrian passage across the Charles River on the MBTA bascule bridge.

Rutherford Avenue Parcel: The parcel is planned as a buffer between Charlestown and Project structures behind the parcel.

Nashua Street Park: This 2.6-acre linear parcel will include a walkway connecting to the Esplanade upstream via the new pedestrian overpass to be built at Leverett Circle. A small area from the Spaulding Hospital site will be added to the park.

North Point East: A riverside parcel of land will be expanded to provide new parkland and a pedestrian link to the walkway over the MBTA railroad tracks, and existing pilings and the deck of an old railroad trestle will be removed subject to consultation with the owner(s). A portion of the new water feature, described below, will be located here.

North Point West: Riverside parkland along North Point inlet and a new water feature are the main components of this park. Walkways will connect the Museum of Science to North Point East through this area. Banks of the new water feature will be planted with wetland vegetation. The MDC central services facility will be relocated prior to development.

Historic Dam North: North of the historic lock, the stables and boathouse will be upgraded and parklands refurbished.

Historic Dam South: South of the lock, historic MDC buildings will be upgraded and parklands refurbished.

North Point Wilds: A new park of 6.3 acres between the proposed North Point development and the MBTA railroad right-of-way will become a buffer area.

The EOTC, MHD, and MDC have entered into an Amended and Restated Memorandum of Agreement regarding the roles and responsibilities of implementing the above New Charles River Basin mitigation program. It is appended to the end of the Final Section 4(f) Evaluation in this document.

Certificate of the Secretary of Environmental Affairs on the Draft Environmental Impact Report/Statement

October 15, 1993

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

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October 15, 1993

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT/STATEMENT

PROJECT NAME : Central Artery/Tunnel Project - Charles River Crossing
PROJECT LOCATION : Boston
EOEA NUMBER : 4325
PROJECT PROPONENT : Massachusetts Highway Department
DATE NOTICED IN MONITOR : August 10, 1993

The Secretary of Environmental Affairs herein issues a statement that the Draft Supplemental Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and with its implementing regulations (301 CMR 11.00).

The Draft Supplemental Environmental Impact Report/Statement (DSEIR/S) describes three alternatives for the Charles River Crossing and compares them to "Scheme Z" which was the proposed plan for this section of the Central Artery/ Tunnel (CA/T) project in the previous reports reviewed under MEPA. In addition, the report describes modifications, referred to as design refinements, which may be incorporated into the three alternatives.

DSEIR/S Alternatives

The new alternatives, referred to as 8.1D Mod 5, the Reduced River Tunnel, and the Non-River Tunnel Alternatives, were developed in response to serious concerns that were raised about impacts of Scheme Z in terms of aesthetics, traffic operations, parkland, land use, water resources, navigation, etc.

Alternative 8.1D Mod 5 was developed during an extensive public process undertaken by the Secretary of Transportation and Construction (EOTC) and the Bridge Design Review Committee

(BDRC), and was first proposed under MEPA in a Notice of Project Change (NPC) in 1992. It includes the construction of a single cable stayed, 10 lane bridge across the Charles River; one elevated loop ramp north of the river; a three lane tunnel under the Charles River; tunnels under the North Station platform; a total length of 10,100 linear feet of tunnel; and one ventilation building on the south side of the river. Construction duration has been estimated at 13 years.

This DSEIR/S was required in response to the NPC. Because of concerns with traffic safety and impacts on water resources, the NPC Certificate/Scope issued on March 11, 1993 allowed the MHD to develop additional alternatives.

The Reduced River Tunnel Alternative involves constructing a 12 lane, cable-stayed bridge on twin towers; two elevated loop ramps on the north side of the river; a two lane tunnel under the Charles River; a pair of tunnels under the North Station railroad platform; a total of 6,150 linear feet of tunnel; 2 ventilation buildings (one on either side of the river); and a construction duration of 9 years.

The Non-River Tunnel Alternative would involve constructing two bridges with a total of 14 lanes across the Charles River; three loop ramps, reducing to two, on the north side of the river; a pair of tunnels under the North Station railroad platform; a total of 3,300 linear feet of tunnel; one ventilation building on the south side of the river; and a construction duration of 8.5 years.

Design Refinements

The DSEIR/S also describes, in a preliminary way, several modifications for each of the three alternatives that are being or have been examined as possible ways to minimize their impacts.

For Alternative 8.1D Mod 5, the following refinements are identified:

1. A single ventilation building instead of two.

2. A fin back type bridge structure instead of long-span options.

3. Redesigning Leverett Circle/Nashua Street by realigning the Storrow Drive /local to north traffic movements so as to eliminate the tightly curved geometry for Ramp L-N near

Leverett Circle. This refinement would also entail eliminating Ramp M-N at Lowell Square and changing the N-L access to Nashua Street. The Registry Building (100 Nashua Street) would have to be demolished in order to accomplish these modifications.

For the Reduced River Alternative, the following refinements are described:

1. Realignment of the (reduced) river tunnel. Referred to as refinement 2.6.2(a), this alignment would allow Storrow-Tobin and Storrow-I-93 northbound movements to pass under the Charles River just west of the existing bascule railroad bridge. Its compatibility with the Orange Line tunnel, the proposed North Station/ South Station Rail Link alignment, as well as special construction techniques to minimize vibration impacts to the dam and other sensitive receptors would need further evaluation.

2. Redesign of Leverett Circle/Nashua Street Area. Similar to the above described refinement for Leverett Circle/Nashua Street, this alignment would differ by having the C-T traffic use the I-93 mainline bridge to cross the Charles River, providing a connection to the Tobin Bridge via a second viaduct loop ramp in East Cambridge. Other modifications would include realignment of Ramp S-N/M-N (Storrow/Merrimac-to-north) and the elimination of Ramp M-N at Lowell Square. According to the DSEIR/S, this refinement will necessitate the demolition of the Registry Building, rather than underpinning the building as in most alternatives/refinements.

3. I-93 northbound right hand exit. This refinement would minimize the overall aesthetic impact of the mainline crossing and in particular impacts on the Paul Revere Park South by changing the I-93 northbound mainline from a four lane plus two lane configuration to five lanes.

Lastly, the following are described as possible refinements for the Non-River Tunnel Alternative:

1. Realignment of Storrow-to-north traffic movements. This modification could reduce the number of lanes on the bridge from 14 to 12 by placing two traffic movements (Storrow-to I-93/Tobin) in tunnel.

2. I-93 right hand exit as described above, would reduce the

required width of the bridge and related impacts on Paul Revere Park South.

3. Realignment of Ramp CN-L (I-93 northbound to Nashua Street). Further variations on this idea being considered would minimize impacts to parcels that are being proposed for parkland development.
4. Refinements to the new eastbound underpass at Leverett Circle in order to minimize impacts on Storrow Drive and on Charles River Park.

Focus of this Certificate

The many significant impacts associated with Scheme Z are what triggered the decision to undertake this further review of the CA/T project component known as the Area North of Causeway Street. While the DSEIR/S still refers to Scheme Z as the Proposed Action, it can be safely assumed that an alternative to Scheme Z will be selected, especially given the extensive, and commendable, efforts by the CA/T project staff to improve on Scheme Z in recent months. Indeed, the DSEIR/S characterizes the majority of impacts associated with the three alternatives, except cost, as improvements to Scheme Z.

This Certificate will, therefore, focus on the three new alternatives, consistent with the previous FEIR and NPC Certificates. It will not, however, identify a preferred alternative among the three. This remains the responsibility of the EOTC and the Massachusetts Highway Department (together, the proponent) who must take into account environmental, traffic efficiency and safety, as well as cost considerations. Moreover, based on my review of the DSEIR/S and the many comments, it appears that environmental impacts will not be the determinative factor in the selection of a preferred alternative. I believe the main reason to be that the combined environmental impacts are the same or similarly significant in each of the three alternative scenarios. Furthermore, to the extent one alternative offers a clear advantage in one area, it frequently increases adverse impacts in another area (for example, visual, aesthetic and shadowing versus water quality and navigational impacts). While it may be possible to make this trade-off more acceptable through further refinements, it is essentially unavoidable. This, too, makes it impossible to point out a clear "winner" in terms of environmental impacts.

Objectives of this Certificate

This Certificate intends to provide guidance to the proponent in the preparation of the FSEIR/S by identifying areas where additional data and/or analysis is needed. In addition, it provides guidance to both the proponent and the permitting agencies as to how, in my opinion, the review process should proceed to closure. With these objectives in mind, I believe it is necessary to first place the remainder of the review in proper context and perspective. I will then offer some broad conclusions as to how the analysis of alternatives, impacts and mitigation should be finalized. Finally, I will offer more specific comments in various substantive subareas.

The Big Picture

To quote the SFEIR Certificate which was the starting point for this review of alternatives to Scheme Z:

> "Any solution to this snarl of roads, waterways, parks, buildings, neighborhoods, and railroad tracks will have significant impacts. Yet, unless the traffic is to be directed west of Hopkinton, the headwaters of the Charles River, any solution will have to involve some compromise on all fronts. We cannot solve our transportation problems perfectly if the price to the environment is too great. And similarly, the legitimate need to correct very real transportation problems may mean the loss of some potential parkland or the alteration of some natural resource."

It is important to acknowledge, more than many commenters have been willing to do thus far, this unavoidable need to balance differing and often conflicting interests, not simply transportation against environment, but also environmental impacts in one area against those in another. The comments on the DSEIR/S make this abundantly clear when one constituency advances one alternative as preferable and another entity condemns the same as unacceptable (the non-river-tunnel alternative). It must be clear that the ultimate preferred alternative will involve compromise and will result in impacts on environmental resources and neighborhoods, which, if focused on out of context, might seem possible to avoid or minimize to a greater degree. Similarly, the ultimate combination of mitigation measures for the project may be less than the total of what could potentially be required by different agencies under separate sets of regulations, when there is no coordination between them.

Since few parties argue that this project should not proceed, an additional concern has to be that the review process remains focused on resolution of outstanding issues as soon as possible. I believe it is reasonable to keep this timing consideration in mind when deciding how much more analysis needs to be done, but also in anticipating decisions that need to be made in the subsequent, permitting and licensing stage. This is one of the concerns underlying the broader determinations in this certificate.

Having said this, I should perhaps clarify that I do not discount the concern expressed by many commenters that the DSEIR/S has supplied a less than complete analysis of impacts and mitigation. I agree with many, including permitting agencies, that the documentation on this point can and should be improved, as the sections below will indicate. I also emphasize here the important MEPA mandate under which I must insist that the proponent articulate clear and detailed commitments to mitigation measures, including responsibilities and time schedules for implementation. Equally important under MEPA is the need to make these commitments as part of the public review process, i.e. they must be set forth in the FSEIR/S.

Alternatives - FSEIR/S

I encourage the proponent to select and publicly announce a preferred alternative as soon as possible and make this alternative the main focus of the FSEIR/S. Of course, this selection needs to be based on a comparison with the alternatives. While the analysis of each alternative need not be at the same level of specificity, I ask the proponent to respond to comments that seek to avoid comparison of the worst case version of one alternative with the best case version of another. This applies in particular to further analysis of mitigation measures. The analysis needs to be sufficiently thorough to permit a fair, comparative evaluation of impacts, and thus to support the selection of the preferred alternative.

Mitigation

Because there is significant overlap between areas of impact and regulatory programs, for example in the area of parklands and waterfront access, I believe it is reasonable to credit mitigation measures under more than one set of regulations or for more than one purpose when they are, in fact, the right type of mitigation. I urge the proponent as well as the interested agencies to focus on developing a package of mitigation that is appropriate for the project as a whole. I also consider it reasonable to take into account overall cost limitations when developing this mitigation program, if only since cost will undoubtedly be a major factor in the selection of the preferred alternative.

I further believe that the resolution of mitigation issues needs to occur substantially within the period of remaining MEPA review, i.e. should not be postponed to the permitting/licensing stage. There are several reasons for this. One is the concern with moving this project forward at a reasonable pace. Another that completion of the MEPA process clearly requires enforceable commitments to mitigation, even when such commitments can be subsequently imposed as permit or license conditions. Finally, there is great public concern with the mitigation aspect of this project and without proper and timely resolution of this issue, the project will not have the public acceptance it needs.

With these concerns in mind, I request that the proponent give serious consideration to early implementation of mitigation measures wherever possible and that the FSEIR/S reflect this in the implementation scheduling.

Transportation

One of the most important aspects of the balancing of impacts required in the proponent's selection of a preferred alternative relates to the potential traffic impacts in East Cambridge and in the Boston neighborhoods of Charlestown, Beacon Hill and the West and North Ends, which vary with the alternatives and design refinements under consideration. As is evidenced by comments which reflect concerns about traffic impacts in these areas, elements of a particular alternative may appeal to one neighborhood, yet the same alternative may result in impacts in another section of the project area which some commenters deem "unacceptable." An example which applies to all three new alternatives is the proposed relocation of Ramp C-L out of City Square as proposed under "Z" and into Rutherford Avenue, near Bunker Hill Community College. While this ramp relocation would improve traffic operations at City Square, additional analysis is needed to determine the impacts/mitigation at Rutherford and its' vicinity. Similar issues are raised by alternatives/ refinements which impact Leverett Circle, Beacon Hill and the area near North Station.

The impacts on vehicular, pedestrian (and other non-vehicular) traffic and transit operations warrant further clarification in the FSEIR/S which should be responsive to relevant comments on transportation issues. A more specific and detailed analysis of impacts and mitigation measures is especially required for the preferred alternative. More information is also needed on the alternatives so as to ensure a fair comparison, although this part of the analysis may include less detail. Furthermore, the following specific transportation issues will have to be addressed in the FSEIR/S:

1. Greater consideration of the potential impacts on the Charlestown and Cambridge communities of the proposed, relocated C-L Ramp. The FSEIR/S must depict more clearly the vehicular, pedestrian and transit impacts of this element of the project, as well as air quality and noise impacts, identify mitigation and evaluate its effectiveness. Also, respond to the many suggestions that this ramp be relocated to Sullivan Square, rather than at Rutherford Ave. From a traffic operations (and/or other) perspective, what are the implications of such a proposal? Particular attention should be paid to the likely effects of the ramp on Bunker Hill Community College and other institutional, commercial and residential entities, and to methods that will avoid or minimize such effects.

   Note that there are also land use implications associated with relocating Ramp C-L which should be addressed, based on discussion found further in this document.

2. Traffic Operations at or related to Leverett Circle. The major flaw of Alternative 8.1D Mod 5 is the failure to provide acceptable Level of Service for Leverett Circle. Other alternatives fare better in this regard, due to the fact that they include plans for grade separation at Leverett Circle, removing the major movement of Storrow-I-93 North.

   The FSEIR/S will need to expand on the description of traffic operations associated with the selected alternative for Leverett Circle. Comments from the MDC, City of Boston agencies, as well as representatives of Charles River Park, Beacon Hill and other affected neighborhoods must be given close attention, in particular as they relate to the extent of study area, efficiency of traffic operations, and potential penetration of residential areas.

3. Proposed At-Grade Intersection in the Millers River. Further analysis of this intersection may be warranted, based on a comment from the EPA which suggests that modifications may be required by the FHWA for this area of the project.

Air Quality

Mobile Sources

Air quality from mobile sources is predicted to be slightly better for all three alternatives than for Scheme Z, which is contributed in part to a reduction in overall Vehicle Miles Traveled (VMT) and the inclusion of an I-93 southbound High Occupancy Vehicle (HOV) lane in each of the three new alternatives. According to the DSEIR/S, the Reduced River Tunnel Alternative will provide the lowest emissions of Carbon Monoxide, partly because of traffic operations predicted for the three intersections at Leverett Circle, Keaney Square, and City Square.

A remaining question is whether further benefit can be derived from enhanced HOV facilities or incentives for rail/transit use as suggested by some commenters. Also, it is not clear whether additional benefit would be predicted if the analysis took into account the Project Change associated with the CANA Loop Ramps currently under review (EOEA# 2670), which will extend the I-93 southbound HOV lane approximately to Sullivan Square. This issue and HOV related comments from others should be expanded on in the FSEIR/S, with specific reference to applicable provisions of the Intermodal Surface Transportation Efficiency Act (ISTEA).

Stationary Sources (Vent Building(s))

Although all alternatives were predicted to comply with federal and state air quality standards for CO, PM_{10}, and NO_2 with only slight differences, questions have been raised by the Department of Environmental Protection regarding the analysis conducted to date and whether the use of more current modeling software would have any bearing on the outcome of the analysis. These questions and others related to this topic should be addressed in the FSEIR/S, and additional modeling using currently accepted programs should be done if appropriate.

Water Quality

For all three new alternatives, the SFEIR/S will need to provide additional information regarding the construction techniques and mitigation to be employed to minimize water quality impacts. This is especially true for the Reduced River Tunnel Alternative (and associated refinements) as well as Alternative 8.1D Mod 5. Issues which need to be addressed include the following:

1. A demonstration that construction of a cofferdam is feasible, and/or detail as to how it would be constructed and dewatered.

2. A more detailed analysis of the way in which excavate and dredge spoil material will be managed, including the ultimate disposal of these materials. The FSEIR/S will have to demonstrate whether and how the South Boston Materials Processing Operation (MPO) will be able to process the materials to be taken from this portion of the CA/T Project in addition to its existing commitments. If necessary, another method or site will have to be identified and evaluated in the FSEIR/S.

3. The impacts of transporting material away from the site on traffic must be clarified and the opportunity for rail use, suggested by the MA Coastal Zone Management Office should be explored in the FSEIR/S. A related issue is the feasibility of ocean disposal of suitable material given limitations on the barge size that can pass through the MDC dam.

4. The DSEIR/S suggests that some (contaminated) material may be disposed of on site in the graving basin when its use has expired. More information as to the logistics of how this can be accomplished should be provided in the FSEIR/S, including any temporary mitigation which may be required if such material would be stored onsite. Furthermore, the FSEIR/S is expected to contain a better characterization as to the nature and extent of materials that will have to be disposed of, depending on tunnel options that may be chosen.

Wetlands

Considerable controversy has been generated by the characterization in the DSEIR/S of wetland resources associated with the Millers River. For example, the Cambridge Conservation Commission and DEP have challenged the estimate of Bordering Vegetated Wetland (bvw) likely to be impacted by the proposed fill for the local access ramps that are associated with all three new alternatives. These agencies suggest that more recent surveys of the site by their staff have indicated the existence of a greater area of bvw than reflected in the DSEIR/S. The FSEIR/S must clarify the basis for the DSEIR/S findings and/or supplement them with results of a new survey, as appropriate. A possible inconsistency with delineations and evaluations reported in earlier EIR(s) should also be addressed. I expect the SFEIR/S to include a description of the species which were found, a reasonably scaled map depicting the delineated boundary, and a narrative description of the extent of area involved. The Cambridge Conservation Commission and the DEP Northeast Region should be given the opportunity to view the flagged site prior to the SFEIR/S filing, in an attempt to obtain their concurrence with the delineation presented in the SFEIR/S. It may be appropriate to include the Boston Conservation Commission in this effort also, since a determination issued by it in April of 1991, may have expired by now.

Another issue to be clarified is the significance of the Millers River to the flood control interest protected by the Wetlands Protection Act. This issue was apparently considered differently in earlier stages than in the DSEIR/S.

Related issues include whether the baseline conditions described for the Millers River should reflect its condition today or an enhanced condition based on not yet accomplished, but previously made mitigation commitments under Chapter 91 Waterways licensing for the CANA Tunnels; and the permittability of the proposed alterations to the Millers River under state regulations.

Determination of Baseline Conditions

The DEP and others have stated that the baseline conditions for the Millers River should include improvements that have been identified previously as permit conditions for the Chapter 91 license issued for the CANA project. The proponent has indicated in a very general sense that improvements to the Millers River are no longer warranted as CANA mitigation, based on the current plans to place the CANA loop ramps farther away from the waterfront than would be needed with the Scheme Z alternative. While it may not be inappropriate for the MHD to assume that CANA mitigation should be lessened commensurate with a lessening of impacts, this requires an amendment of its Chapter 91 license.

Accordingly, I recommend that the proponent provide greater detail to DEP and work with DEP to resolve Chapter 91 related mitigation matters. The SFEIR/S must clarify why previously agreed to commitments for improvements to the Millers River no longer apply, based on a detailed description and evaluation of the changes to the CANA Project. This discussion should also address Waterways issues identified in the discussion below. I urge the proponent and the DEP to consider the possibility of overlap between this project and the CANA Project and to cooperate in determining what combination of mitigation measures would be appropriate.

WPA Performance Standards

In general, the discussion provided in the DSEIR/S of foreseeable impacts to state regulated wetland resources and of the performance standards for accomplishing the proposed work is sketchy, necessitating a good deal of clarification in the FSEIR/S with respect to the Millers River. Close attention should be paid to relevant comments from others on this issues.

To begin with, the methodology used for delineating state regulated wetland resource areas must be described more clearly. It appears that the delineation of bvw is defined by reference to an elevation used for delineation under federal regulation, rather than by an inventory of the plant species as required under state law (see Appendix D). This may account for some or all of the discrepancy between the amount of bvw that the Cambridge Conservation Commission and DEP suggest may exist and the assertion in the DSEIR/S that 180 square feet of bvw will be affected.

Waterways

Water Dependency

The proponent makes a key assumption in the DSEIR/S that the entire Charles River Crossing should be considered a water dependent use for purposes of Chapter 91 licensing requirements. This assumption is based on the Certificate on the Draft Supplemental EIR, dated August 29, 1990, in which my predecessor reached such a determination for three "infrastructure crossing facilities" associated with the CA/T project, including the Charles River Crossing. The assumption ignores, however, the more recent and more directly applicable Certificate on the Notice of Project Change dated March 11, 1993. This Notice of Project Change introduced the 8.1D Mod. 5 alternative.

The latter Certificate specifically provided that the proponent "should consider the issues of water dependency vs. non-water dependency for relevant pieces of the project, and develop mitigation as warranted." Clearly, this acknowledged the possibility that parts of newly developed alternatives might be structures not within the provision in the Chapter 91 regulations under which an infrastructure crossing facility "or any ancillary structure thereto" must be considered water-dependent "if the Secretary has determined that such facility cannot reasonably be located or operated away from tidal or inland waters . . . ." This determination must be based on a comprehensive analysis of alternatives and measures that can avoid or minimize adverse impacts on the environment.

Comments from the DEP in particular point out that the proponent has failed to show why components of the currently proposed alternatives that are not part of, nor lead to or from, the actual crossing, should be considered water dependent. Consequently, DEP has called for such an analysis which it clearly expects should include additional commitments to mitigation, as well.

I concur with the DEP that the DSEIR/S should have included this analysis. I also understand the concern expressed by several commenters that the proponent comply fully with the mitigation requirements of the law, as every other project must. Finally, I am aware that mitigation has become an issue of serious concern with respect to other parts of the CA/T project. In particular, questions have been raised regarding the proponent's willingness to commit to specific mitigation measures and to implement commitments made previously.

There can be no doubt that, apart from what Chapter 91 requires, MEPA mandates specific commitments to detailed mitigation measures as part of the environmental impact review process. I believe this should be the focus of further review of waterways issues, consistent with what I said earlier about taking a look at the big picture and developing a mitigation package that is appropriate for the project as a whole.

Because the DSEIR/S did not adequately address this issue, it is not possible for me to determine whether all of the proposed alternatives, with or without various refinements, fit within the concept of infrastructure crossing facilities and their ancillary structures that can not reasonably be located further away from tidelands or inland waters. I will not, however, revisit the determination made for Scheme Z. Accordingly, the proponent and DEP should assume that any structure or part of the project that was part of Scheme Z, including structures that are "ancillary" to the actual crossing facility in the same or a similar manner as they were in Scheme Z, are water dependent. This includes structures that are necessary to the proper operation of the crossing facility from a technical design, traffic operations or mitigation perspective. In addition, structures or project components that serve both a water dependent and a non water dependent use, are to be considered water dependent.

I believe this determination is appropriate given the previous decision regarding Scheme Z, the need to focus on a mitigation package for the project as a whole, and the expectation that the FSEIR/S will provide more specific information on alternatives and measures that can avoid, minimize or mitigate adverse impacts. In other words, I believe that the development of an appropriate mitigation package need not hinge on the water dependency issue. I encourage the proponent to provide more detailed information about design and location of project components in areas subject to Chapter 91, and to work with DEP to resolve questions about water dependency that remain despite the guidance provided in the preceding paragraph. Above all, however, I require the FSEIR/S to include a full and detailed mitigation proposal that clearly identifies the measures to be taken, a time schedule for implementation, and persons or entities responsible for implementation.

Navigation - Charles River

Some commenters have pointed out that the number of piers in the Charles River associated with the Non-River Tunnel Alternative would be 9.5 as compared to 11 piers for Scheme Z. By contrast, 8.1D Mod 5 and the Reduced River Tunnel Alternatives would have 1 and 1.5 piers, respectively. The FSEIR/S must address concerns that have been raised about the likely navigational impacts associated with the queuing of recreational boats that must wait for access through the locks and under the bascule bridge. How will impacts on navigation from the bridge and/or tunnel construction be minimized, during the construction duration as well as in the long term?

Navigation - Millers River

The proponent contends in the DSEIR/S that there are no navigational impacts associated with the proposed work in the Millers River, given its existing condition. The DEP and others contradict this point. Resolution of this issue and others relating to the status of the Millers River must be worked out prior to the FSEIR/S. I encourage the proponent and agencies with jurisdiction for this aspect of the project to cooperate fully in this effort.

Chapter 91 Mitigation

The FSEIR/S discussion of tidelands impact and mitigation will need to be very clear in order to be deemed adequate. In particular, issues must be resolved that relate to assumptions that the proponent has made regarding the current validity of tidelands mitigation requirements of the Chapter 91 license for the 1987 CANA project, given changes in the configuration of the loop ramps that are anticipated.

The configuration of the CANA Loop Ramps, as licensed in 1987, was compatible with Scheme Z and encroached further onto tidelands than would any of the new alternative configurations. The new alternatives will allow the ramps to be shifted further away from the north banks of the Charles River, thus affecting less tidelands.

The DSEIR/S states that 50% of the CANA project and mitigation has been constructed to date (see p.13 of Appendix D) and that "no additional mitigation for CANA impacts is required" because of the increased setback from the north banks of the Charles River provided with the new alternatives. This statement seems premature in that a revised mitigation package for the CANA ramps will necessarily involve an amendment to the DEP license and a Notice of Project Change under MEPA. The latter can be accomplished in the FSEIR/S which must demonstrate that proposed mitigation for the entire crossing area is commensurate with the tideland impacts.

In this regard, I recommend the following course of action:

1. The MHD and DEP must meet and finalize outstanding issues of water dependency in accordance with the guidelines set forth at the beginning of this Waterways section.
2. The MHD should then develop and describe in detail in the

FSEIR/S, a proposal for tidelands mitigation for all activities subject to Chapter 91 within the Charles River Crossing project area, including the area north of the river. Where changes in mitigation commitments are offered, the original commitments must be described and compared to the new proposal, with an attempt to justify how the new plan is proportional to the revised project's impacts.

Land Use Issues

A number of land use impacts, some temporary and some permanent, have been described in the DSEIR/S. The actual extent and locations of these impacts will vary, based on the preferred alternative selection. In any event, critical land use discussions will involve the land uses in the immediate vicinity of the mainline crossing (e.g., Paul Revere Park North and South, North Point, North Station operations, etc.) as well as the Bunker Hill Community College athletic fields and others.

Some of these issues will be driven by determinations under Section 4(f) of the federal Department of Transportation Act and/or Chapter 91. Others, such as the proposed intersection at Rutherford Avenue, may be a function of traffic operations more than any other factor. Thus, although related discussions of these topics may appear in a number of different sections of the FSEIR/S, they should also be discussed within the context of land use impacts/mitigation.

Parkland/Open Space

The SFEIR/S must be clear in its commitments to mitigate impacts on parkland and open space, whether the mitigation is triggered by state or federal programs. The SFEIR/S should include clearly depict mitigation which is proposed, including a plan (schedule) for implementing commitments. The proponent should consider seriously the importance of implementing some elements of the mitigation package for parkland/open space impacts before the completion of the entire construction project.

A significant number of comments focus on requirements under Section 4(f). The related analysis was incorporated in the MEPA scope for the DSEIR/S because in this case compliance with MEPA cannot be considered complete without compliance with Section 4(f). I do not have the authority to determine the adequacy of the analysis under the federal statute. I note, however, that many concerns arise under both federal and state law, and look forward to a final Section 4(f) analysis in the FSEIR/S that clearly identifies impacted parklands and describes proposed mitigation in detail.

Charlestown

Comments from the Charlestown community overwhelmingly encourage the proponent to change the location of Ramp C-L from Rutherford Avenue to Sullivan Square. When considering ways to further mitigate traffic impacts to Charlestown and in particular Bunker Hill Community College, the FSEIR/S must evaluate how and whether this traffic movement could be accommodated at Sullivan Square.

North Point

The loop ramps on the north side of the river as well as construction activities, especially for tunnel alternatives, will impact this area in Cambridge. The FSEIR/S must provide a specific discussion of the impacts of the project on this area of Cambridge both for the short and long term, considering current and planned land use(s). This discussion should include mitigation.

Beacon Hill, West End, North Station and Vicinity

A number of comments express concerns about potential impacts on land uses in these locations south of the Charles River that I expect the FSEIR/S to address.

Construction

A variety of temporary construction impacts will need to be mitigated depending on the selected alternative. The FSEIR/S should describe these in detail, considering all of the relevant areas of impact.

Historic Resources

The major issues under this topic that needs to be explored in the FSEIR/S relate to the preservation or disposition/demolition of Registry Building and to the mitigation required for the granite seawalls on the north bank of the Charles River.

Registry Building

The DSEIR/S assumes that the Registry Building (100 Nashua Street), which is eligible for listing on the National Register of Historic Places, will be underpinned for most alternatives and design refinements presented. However, some commenters, including the Division of Capital Planning and Operations (DCPO), have questioned the benefit of preserving this structure, given the cost involved and the possible difficulty of attracting tenants to the site in the future who may be affected by access issues and changes in land use surrounding the site. I urge the DCPO, Massachusetts Historical Commission (MHC) and other interested agencies to resolve their differences regarding this issue in cooperation with the proponent.

The necessity of saving the Registry Building should be one of the cost factors considered by the MHD, regardless of its choice for a preferred alternative, based on these comments. If the final determination can be made prior to when the FSEIR/S is filed, the FSEIR/S should provide this information. In this case, if the determination is not to preserve the registry, historical documentation of the building, as required by the MHC in such cases, should be included in the FSEIR/S.

Granite Seawalls

The project will impact historic seawalls on the north bank of the river, especially with alternatives involving tunnels under the Charles River. I encourage the MDC, the MHC, the proponent and other interested agencies to cooperate towards an agreement on appropriate terms for mitigation.

Other Issues

Ancillary Facilities

The DSEIR/S identifies the following facilities that are related to the project, but provides no substantive detail:

- o Relocation of the electrical substation.
- o Construction of an MHD Maintenance Facility and facilities north and south of the river for emergency response purposes.

Additional information about these facilities must be provided in the FSEIR/S, which will, among other things, minimize the need for future Project Change Notices under MEPA. The FSEIR/S should also address environmental impacts from these facilities, if any.

Hazardous Cargo

Clarification of the routing of truck traffic containing hazardous cargo, responding to issues raised by commenters on this subject should be provided in the FSEIR/S.

Comments

The number of comments that were submitted as well as the level of detail of many of them is a testimony to the level of concern with and interest in this project from a broad variety of parties. The FSEIR/S should respond to these comments in accordance with the instructions provided at 301 CMR 11.07(10).

Finally, I am aware of the magnitude and complexity of the tasks involved in preparing the FSEIR/S. A significant part will require coordination between the proponent and other state agencies, especially to resolve outstanding questions regarding impacts and mitigation. This office stands ready to be of assistance to any of these participants should it be needed.

October 15, 1993
DATE

Trudy Coxe, Secretary

Comments received :

8/5/93	Kaiser
8/6/93	Kaiser
8/31/93	Boston Water and Sewer Commission
9/1/93	Boston Fire Department
9/11/93	Liberty Bell Wholesale Grocery Co. Inc
9/14/93	Save the Harbor Save the Bay
9/14/93	Boston Transportation Department
9/14/93	Boston Environment Department
9/14/93	McCarthy
9/15/93	Move Massachusetts 2000
9/15/93	Representative Voke

9/17/93	Caravan
9/18/93	First Properties, Inc.
9/24/93	Boston Greenspace Alliance
9/26/93	Citizens Transportation Action Campaign
9/27/93	Massachusetts Association of Conservation Commissions
9/27/93	Roudebush
9/29/93	Rizzo Assoc.
9/29/93	Davison
9/30/93	Cambridge Planning Board
9/30/93	Bridge Design Review Committee
9/30/93	Perk
9/30/93	New Boston Garden Corporation
9/30/93	Bridge Design Review Committee
10/1/93	ASERT
10/1/93	Senator Travaglini
10/1/93	Bahne
10/1/93	Jaffe
10/1/93	Charlestown Patriot
10/1/93	Conway
10/2/93	Life Focus Center, Inc.
10/4/93	St. John
10/4/93	General Services Administration
10/4/93	Boston Preservation Alliance
10/4/93	Bunker Hill Monument Association
10/4/93	Travaglini
10/4/93	Cambridge Citizens for Liveable Neighborhoods
10/4/93	Citizens for a Liveable Charlestown
10/4/93	Iorns
10/4/93	Pollalls (Harvard University)
10/4/93	Conservation Law Foundation
10/4/93	MA Coastal Zone Management
10/4/93	Massachusetts General Hospital
10/4/93	Charles River Watershed Association
10/4/93	Central Artery Oversight Committee
10/4/93	Charlestown Preservation Society
10/4/93	Davis
10/4/93	Beacon Hill Civic Association
10/5/93	Metropolitan District Commission
10/5/93	Casendino & Company
10/5/93	National Trust for Historic Preservation
10/5/93	Sierra Club
10/5/93	Brad Bellows Architects
10/5/93	Boston Society of Landscape Architects
10/5/93	Pangaro
10/5/93	G. Conway, Inc.
10/5/93	Artery Business Committee

10/5/93	Downtown North Association, Inc.
10/5/93	1000 Friends of Massachusetts
10/5/93	Cambridge City Manager
10/5/93	Cambridge Conservation Commission
10/5/93	Kaiser
10/5/93	US Environmental Protection Agency
10/5/93	Massachusetts Audubon Society
10/5/93	Boston Landmarks Commission
10/5/93	Boston Environment Department
10/5/93	MBTA
10/5/93	Division of Capital Planning and Operations
10/5/93	Representative Businger
10/5/93	Charlestown Neighborhood Council
10/5/93	DEP
10/4/93	Boston Area Bicycle Coalition
10/5/93	Division of Marine Fisheries
10/5/93	Rappaport and Rakov
10/5/93	Cambridge Street Community Development
10/5/93	Beacon Hill Civic Association
10/5/93	The Boston Harbor Association
10/5/93	Boston Redevelopment Authority
10/5/93	Bunker Hill Community College
10/5/93	Charlestown North Area Task Force
10/5/93(rec'd)	Kverek
10/5/93(rec'd)	Stone
10/5/93	Boston Transportation Department
10/5/93	Zuk
10/8/93	Boston Edison
10/13/93	Somerville Office of Housing and Community Development

TC/JIW/JR/jw

SUMMARY OF RESPONSES TO THE MEPA CERTIFICATE ON THE DSEIS/R

The MEPA Certificate on the DSEIS/R was issued on October 15, 1993. A copy of the Certificate is included in this FSEIS/R. It states that the ultimate choice of the Preferred Alternative involves compromise and will result in impacts on environmental resources and neighborhoods. The choice must balance differing and often conflicting interests: transportation versus environment, environmental impacts in one area versus those in another. A summary of issues raised and specific requests in the MEPA Certificate follows, with summary responses; sections of the FSEIS/R where more detailed responses are located are also indicated.

Long-Term Impacts.

- Additional analysis is needed on the proposed relocation of Ramp C-L; on suggested refinements that affect Leverett Circle, Beacon Hill, and the area near North Station; and on the proposed at-grade intersection in the Millers River.

Response: Ramp C-L has been relocated to Cambridge Street in Charlestown (2.1.4); the Preferred Alternative addresses neighborhood concerns regarding the level of local access and impacts in the Leverett Circle area; the at-grade intersection at the Millers River, while modified to address FHWA concerns, has been retained.

- The information on the routing of hazardous cargo needs clarification.

Response: Hazardous cargo vehicles will not be allowed in the CANA tunnels, by agreement between MHD and the Boston Fire Department, and in compliance with Federal regulations. Adequate alternative routes exist (4.1.4).

- In wetlands impacts, the amount of bordering vegetated wetland (BVW) was questioned by the Cambridge Conservation Commission (CCC). The CCC requested clarification of information on baseline conditions in the Millers River, whether they reflect conditions at present or as committed to by the CANA project.

Response: BVW has been measured again by Project staff in consultation with DEP; the results of this analysis are presented in Section 4.5 and the Wetlands and Waterways Appendix. Information on the Millers River reflects current conditions (4.5 and Wetlands and Waterway Appendix).

- Analysis is required to prove the water dependency of the Preferred Alternative; MHD and DEP must finalize the outstanding issues.

Response: The water dependency of the Project has been analyzed in consultation with DEP, and the results are presented in subsection 4.5.3 and in the Wetlands and Waterways Appendix.

- The future of the Registry building must be clarified. It is eligible for listing on the National Register, but its status is not clear. Funding for its restoration should be included in MHD's cost factors.

Response: MHD remains committed to underpinning and retaining the Registry building unless the building owners, with proper approval, wish to remove the building during Project construction. If removal is desired, MHD will cooperate with the building owners in its removal (5.6.1). Costs for underpinning and repairing the facade are included in Project cost estimates.

Construction Period Impacts.

- Additional information is needed on materials disposal management: their nature and extent; the ability of the South Boston Materials Processing Operation (MPO) to process materials; impacts on traffic; identification of another method or site; the possible use of rail; the feasibility of ocean disposal; the on-site disposal of contaminated material.

Response: Final information on the nature and extent of materials to be disposed will be resolved through the permitting process. With the selection of the Preferred Alternative, the amount of materials to be disposed is within the capacity of the South Boston Materials Processing Operation and of the traffic routes to be used. Unacceptable dredged material will be stabilized, placed in the Millers River, and capped with clean fill; acceptable dredged material will be transported by barge to the Massachusetts Bay Disposal Site (5.3).

- USACE and DEP requested minimization of navigational impacts relating to boats queuing for access through the locks and under the bascule bridge.

Response: The identification of the Preferred Alternative minimizes construction impacts in the river and impacts on boat traffic queuing (4.5.3).

Other Issues.

- Clarification is needed on: relocation of the electrical substation; MHD's maintenance facility and the facilities north and south of the river for emergency response features; and the environmental impacts from these facilities. This information will eliminate the need for more NPCs under MEPA.

Response: The electrical substation and the MHD satellite maintenance facility are proposed to be sited behind the Rutherford Avenue parcel in Charlestown; investigations will continue to determine if the latter can be sited at another similar public facility north of the Project area. The emergency station will be sited in or near the ventilation building on the south bank. The emergency platforms, with no expected environmental impacts, will be sited during the design process (4.2.1(c)).

MEPA CERTIFICATE DIRECTIVES

The following is a summary of the directives in the Certificate of the Secretary of Environmental Affairs, dated October 15, 1993, on the July 1993 DSEIS/R for the Charles River Crossing. The information in parentheses, ( ), indicates where responses to each directive can be found in this FSEIS/R.

1. Proponent must articulate clear and detailed commitments to mitigation measures, including responsibilities and time schedules for implementation. (Chapter 6 describes the measures to be implemented; schedule does indicate if implemented before or during construction. Responsibilities for implementation are indicted in the Amendment and Restatement of the MOA among MDC, EOTC, and MHD (the 1993 MOA), located at the end of the Final Section 4(f) Evaluation.)

2. Mitigation measure commitments must be set forth in the FSEIS/R (see Chapter 6).

3. While the analysis of each alternative need not be at the same level of specificity, I ask the proponent to respond to comments that seek to avoid comparison of the worst-case version of one alternative with the best-case version of another. (Chapter 2 sets forth the rationale for the identification of the Preferred Alternative.)

4. The analysis of mitigation measures needs to be sufficiently thorough to permit a fair, comparative evaluation of impacts, and thus to support the selection of the Preferred Alternative. (The mitigation program is based on the Preferred Alternative. See Chapter 6.)

5. Resolution of mitigation issues [with agencies] needs to occur substantially within the period of remaining MEPA review. (Through meetings with EOEA, DEP, MDC, and Water Resources Committee, this has been done and is reflected in the text. See the 1993 MOA.)

6. I request that the proponent give serious consideration to early implementation of mitigation measures wherever possible and that the FSEIS/R reflect this in the implementation scheduling. (Preconstruction mitigation measures are identified in Chapter 6.)

7. The impacts on vehicular, pedestrian (and other non-vehicular) traffic, and transit operations warrant further clarification in the FSEIS/R which should be responsive to relevant comments on transportation issues (see Section 4.1).

A more specific and detailed analysis of impacts is especially required for the Preferred Alternative. More information is also needed on the alternatives so as to ensure a fair comparison, although this part of the analysis may include less detail (see Chapter 2). Furthermore, the following specific transportation issues will have to be addressed in the FSEIS/R:

(1) Greater consideration of the potential impacts on the Charlestown and Cambridge communities of the proposed relocated C-L ramp. The FSEIS/R must depict more clearly the vehicular, pedestrian,

> and transit impacts of this element of the Project, as well as air quality and noise impacts, and identify mitigation and evaluate its effectiveness. Also, respond to the many suggestions that this ramp be relocated to Sullivan Square, rather than at Rutherford Avenue. From a traffic operations (and/or other) perspective, what are the implications of such a proposal? Particular attention should be paid to the likely effects of the ramp on Bunker Hill Community College and other institutional, commercial, and residential entities, and to methods that will avoid or minimize such effects. (Chapter 2 describes the relocation of Ramp C-L to Cambridge Street southwest of Sullivan Square. The impacts related to this design refinement are assessed in the respective chapters, where appropriate.)

Note that there are land use implications associated with relocating Ramp C-L which should be addressed, based on discussion found further in this document. (Chapter 4.2.1(a) addresses impacts of Ramp C-L relocation.)

> (2) The major flaw of Alternative. 8.1D Mod 5 is the failure to provide acceptable level of service (LOS) for Leverett Circle. Other alternatives fare better in this regard, due to the fact that they include plans for grade separation at Leverett Circle, removing the major movement of Storrow-I-93 north.
>
> The FSEIS/R will need to expand on the description of traffic operations associated with the selected alternative for Leverett Circle. Comments from the MDC, City of Boston agencies, as well as representatives of Charles River Park, Beacon Hill and other affected neighborhoods must be given close attention, in particular as they relate to the extent of study area, efficiency of traffic operations, and potential penetration of residential areas (see Section 4.1.4(a)).
>
> (3) Proposed at-grade intersection in the Millers River: Further analysis of this intersection may be warranted, based on a comment from the EPA which suggests that modifications may be required by FHWA for this area of the Project (see Section 2.1.4(a)).

8. Air Quality-A remaining question is whether further benefit can be derived from enhanced HOV facilities or incentives for rail/transit use as suggested by some commenters (see Subsections 4.1.6(a), (b), and (c)).

Also, it is not clear whether additional benefit would be predicted if the analysis took into account the Project change associated with the CANA loop ramps currently under review (EOEA #2670), which will extend the I-93 southbound HOV lane approximately to Sullivan Square. This issue and HOV-related comments from others should be expanded on in the FSEIS/R, with specific reference to applicable provisions of the Intermodal Surface Transportation Efficiency Act (ISTEA) (see Sections 4.1.8 and 4.1.9).

9. Although all alternatives were predicted to comply with Federal and State air quality standards . . . questions have been raised by the DEP regarding the analysis conducted to date and whether the use of more current modeling software would have any bearing on the outcome of the analysis. These questions and others related to this topic should be addressed in the FSEIS/R, and additional modeling using currently accepted programs should be done if appropriate (see Subsection 4.3.3(c)).

10. Water Quality-For all three new alternatives, the FSEIS/R will need to provide additional information regarding the construction techniques and mitigation to be employed to minimize water quality impacts (see Section 5.10.5). This is especially true for the Reduced River-Tunnel Alternative (and associated refinements) as well as Alternative 8.1D Mod 5 (see also Chapter 2).

Issues which need to be addressed include the following:

> (1) A demonstration that construction of a cofferdam is feasible, and/or detail as to how it would be constructed and dewatered. (The Preferred Alternative does not include a river tunnel.)
>
> (2) A more detailed analysis of the way in which excavated and dredged material will be managed, including the ultimate disposal of these materials. The FSEIS/R will have to demonstrate whether and how the South Boston MPO will be able to process the materials to be taken from this portion of the Project in addition to its existing commitments. If necessary, another method or site will have to be identified and evaluated in the FSEIS/R (see Sec-

tion 5.3).

(3) The impacts of transporting material away from the site on traffic must be clarified and the opportunity for rail use, suggested by the Massachusetts Coastal Zone Management Office should be explored in the FSEIS/R. A related issue is the feasibility of ocean disposal of suitable material given limitations on the barge size that can pass through the MDC dam (see Section 5.3).

(4) The DSEIS/R suggests that some (contaminated) material may be disposed of on site in the graving basin when its use has expired. More information on the logistics of how this can be accomplished should be provided in the FSEIS/R, including any temporary mitigation which may be required if such material would be stored on site. Furthermore, the FSEIS/R is expected to contain a better characterization of the nature and extent of materials that will have to be disposed of, depending on the tunnel options that may be chosen. (No river tunnel is being proposed; therefore, no graving basin is required for the Preferred Alternative.)

11. Wetlands-The FSEIS/R must clarify the basis for the DSEIS/R findings [regarding bordering vegetated wetland] and/or supplement them with results of a new survey, as appropriate.

A possible inconsistency with delineations and evaluations reported in earlier EIR(s) should also be addressed. I expect the FSEIS/R to include a description of the species which were found, a reasonably scaled map depicting the delineated boundary, and a narrative description of the extent of area involved.

Another issue to be clarified is the significance of the Millers River to the flood control interest protected by the Wetlands Protection Act (see Sections 4.5.1 and 5.10.1, and the Wetlands and Waterways Appendix (D)).

12. Millers River Baseline Conditions-The FSEIS/R must clarify why previously agreed to commitments for improvements to the Millers River no longer apply, based on a detailed description and evaluation of the changes to the CANA project. This discussion should also address Waterways issues identified in the discussion below (see Sections 4.5.1 and 4.5.2, and Chapter 6).

13. In general, the discussion provided in the DSEIS/R of foreseeable impacts to State-regulated wetland resources and of the performance standards for accomplishing the proposed work is sketchy, necessitating a good deal of clarification in the FSEIS/R with respect to the Millers River. Close attention should be paid to relevant comments from others on this issue.

To begin with, the methodology used for delineating State-regulated wetland resource areas must be described more clearly (see Section 4.5.1 and Appendix D).

14. I believe this determination is appropriate [water dependency] given . . . the expectation that the FSEIS/R will provide more specific information on alternatives and measures that can avoid, minimize, or mitigate adverse impacts.`

I require the FSEIS/R to include a full and detailed mitigation proposal that clearly identifies the measures to be taken, a time schedule for implementation, and persons or entities responsible for implementation (see Section 4.5.2, Appendix D, Chapter 6 for schedule, and MOA among MDC, EDEA, EOTC, and MHD following Chapter 6).

15. The FSEIS/R must address concerns that have been raised about the likely navigational impacts associated with the queuing of recreational boats that must wait for access through the locks and under the bascule bridge. How will impacts on navigation from the bridge and/or tunnel construction be minimized, during the construction duration as well as in the long term (see Section 4.5.3)?

16. Chapter 91 Mitigation-The FSEIS/R discussion of tidelands impact and mitigation will need to be very clear in order to be deemed adequate.

[After meeting and finalizing outstanding issues with DEP] MHD should develop and describe in detail in the FSEIS/R, a proposal for tidelands mitigation for all activities subject to Chapter 91 within the Charles River Crossing Project area, including the area north of the river. Where changes in mitigation commitments are offered, the original commitments must be described and compared to the new proposal, with an attempt to justify how the new plan is proportional to the revised Project's impacts (see Subsection 4.5.2(d) and Chapter 6).

17. Although related discussions of land use issues may appear in a number of different sections of the FSEIS/R, they should also be discussed within the context of land use impacts/mitigation.

The FSEIS/R must be clear in its commitments to mitigate impacts on parkland and open space, whether the mitigation is triggered by State or Federal programs (see Section 4.2 and Chapter 6).

The FSEIS/R should clearly depict mitigation which is proposed, including a plan (schedule) for implementing commitments (see Section 4.2.6 and Chapter 6). I look forward to a final Section 4(f) analysis in the FSEIS/R that clearly identifies impacted parklands and describes proposed mitigation in detail (see Final Section 4(f) Evaluation, Section 3.8 for mitigation).

18. The FSEIS/R must provide a specific discussion of the impacts of the Project on this area of Cambridge [North Point] both for the short and long term, considering current and planned land use(s). This discussion should include mitigation (see Table 2.1 and Subsections 4.2.1(a) and 4.2.2(a)).

19. A number of comments express concerns about potential impacts on land uses in these locations south of the Charles River [Beacon Hill, West End, North Station and vicinity] that I expect the FSEIS/R to address (see Subsection 4.2.1(a)).

20. A variety of temporary construction impacts will need to be mitigated depending on the selected alternative. The FSEIS/R should describe these in detail, considering all of the relevant areas of impact. (Construction impacts and corresponding mitigation are located in respective sections of Chapters 5 and 6.)

21. Historic Resources-The major issues under this topic that need to be explored in the FSEIS/R relate to the preservation or disposition/demolition of Registry building and to the mitigation required for the granite seawalls on the north bank of the Charles River (see Subsection 4.7.1(b), Section 4.7.3, Chapter 6, and Final Section 4(f) Evaluation, Sections 3.4 and 4.3).

22. The necessity of saving the Registry building should be one of the cost factors considered by MHD, regardless of its choice for a preferred alternative . . . If the final determination can be made prior to when the FSEIS/R is filed, the FSEIS/R should provide this information. In this case, if the determination is not to preserve the Registry, historical documentation of the building, as required by the MHC in such cases, should be included in the FSEIS/R. (Preferred Alternative underpins and preserves Registry building; see Subsection 5.6.1(b) and Final Section 4(f) Evaluation.)

23. The DSEIS/R identifies the following facilities that are related to the Project, but provides no substantive detail: a relocation of the electrical substation, a construction of an MHD Maintenance Facility and facilities north and south of the river for emergency response purposes. Additional information about these facilities must be provided in the FSEIS/R, which will, among other things, minimize the need for future NPCs under MEPA. The FSEIS/R should also address environmental impacts from these facilities, if any (see Section 4.2.1).

24. Clarification of the routing of truck traffic containing hazardous cargo, responding to issues raised by commenters on this subject, should be provided in the FSEIS/R (see Section 4.1.4).

25. The FSEIS/R should respond to [comments submitted] in accordance with the instructions provided at 301 CMR 11.07 (10) (see Chapter 7 and the Appendix in Part II).

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1. Purpose And Need For Action

Chapter 1
PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The Massachusetts Highway Department (MHD) presents this Final Supplemental Environmental Impact Statement/Report (FSEIS/R) for the design of the Charles River Crossing in the Area North of Causeway Street subarea of the Central Artery/Tunnel Project (the Project) in Boston and Cambridge (see Figure 1.1).

This FSEIS/R describes the Preferred Alternative for the Charles River Crossing. It also presents the reasons for rejecting the other new design alternatives and suggested design refinements that were set forth in the 1993 Draft Supplemental Environmental Impact Statement/Report (DSEIS/R). The Preferred Alternative is based on the Non-River-Tunnel Alternative with certain refinements (see Figure 1.2).

The DSEIS/R for the Crossing, published in July 1993, described the four designs that were being considered: Scheme Z, an all-viaduct design and part of the Proposed Action of the approved 1991 FSEIS/R for the Project as a whole; Alternative 8.1D Mod 5, a bridge/tunnel design results from the Bridge Design Review Committee (BDRC) process; and two alternatives to the latter design, the Reduced River-Tunnel and Non-River-Tunnel Alternatives. The DSEIS/R also described refinements to each of the three new design alternatives.

The DSEIS/R evaluated the long-range environmental and short-term construction period impacts of each design. That document addressed issues raised by the U.S. Army Corps of Engineers (USACE), the Federal Highway Administration (FHWA), public agencies, and private groups and individuals during the scoping process in 1992 and 1993. Following publication in July 1993, MHD held a series of community meetings in the affected neighborhoods of Boston and Cambridge, and, on September 14, 1993, at the Museum of Science, a one-day public hearing open to all commenters. Comments received have been considered and responded to and are in Chapter 7 and Part II of this FSEIS/R.

As explained in the 1993 DSEIS/R, the northern limit of the Project was extended northerly to include Sullivan Square in Charlestown near the boundary of the City of Somerville. This was to incorporate a collector/distributor ramp. The I-93 northbound off-ramp to Cambridge Street near Sullivan Square has also been incorporated into the design of the Preferred Alternative since the DSEIS/R.

The Final Section 4(f) Evaluation is published at the end of Part I of the FSEIS/R.

1.2 PURPOSE AND NEED FOR ACTION

The purpose and need for action for the entire Central Artery/Tunnel Project as presented in the 1986 FEIS/R and the 1991 FSEIS/R remain valid. The Project, now underway, will depress and widen the Central Artery (I-93) through downtown Boston to Charlestown and will construct, as an extension of I-90, a new Seaport Access Highway through South Boston, connecting to a new tunnel under Boston Harbor to Logan Airport in East Boston.

The major reasons as stated in the 1991 FSEIS/R for the Project are:

- To increase capacity, reduce congestion, and improve the flow of traffic along the Central Artery from the Charles River to the interchange with the Massachusetts Turnpike (I-93/I-90 interchange); to reduce traffic congestion and improve traffic flow on roadways in the Project area, including those that connect to the Central Artery; and to improve system safety.

- To complete I-90 in Massachusetts, and to double cross-harbor capacity and improve access to Logan Airport.

- To increase accessibility to the South Boston seaport area.

The remainder of the discussion on the purpose and need for action for the Project in the 1991 FSEIS/R is incorporated by reference and not repeated here.

1.3 PURPOSE AND NEED FOR ACTION IN THE AREA NORTH OF CAUSEWAY STREET

The Charles River Crossing links the highway elements on the south side of the river (the new underground Central Artery, Storrow Drive, and the Sumner/Callahan Tunnels) to the regional connections north of the river (I-93 north and Tobin Bridge/Route 1). The connections are in the Project subarea known as the Area North of Causeway Street, the northern limits of which have been extended to Cambridge Street near Sullivan Square in Charlestown. All other Project limits remain the same.

Scheme Z, part of the Proposed Action of the 1991 FSEIS/R, generated comments from agencies, municipal groups, and the general public. The design provided acceptable traffic operations for this complex interchange, but concerns were expressed about its aesthetic and environmental impacts. The three new design alternatives evaluated in the 1993 DSEIS/R sought to reduce the massive size of the crossing, the number and height of the loop ramps and their proximity to the riverbank.

1.3.1 Major Policy Issues Affecting The Charles River Crossing

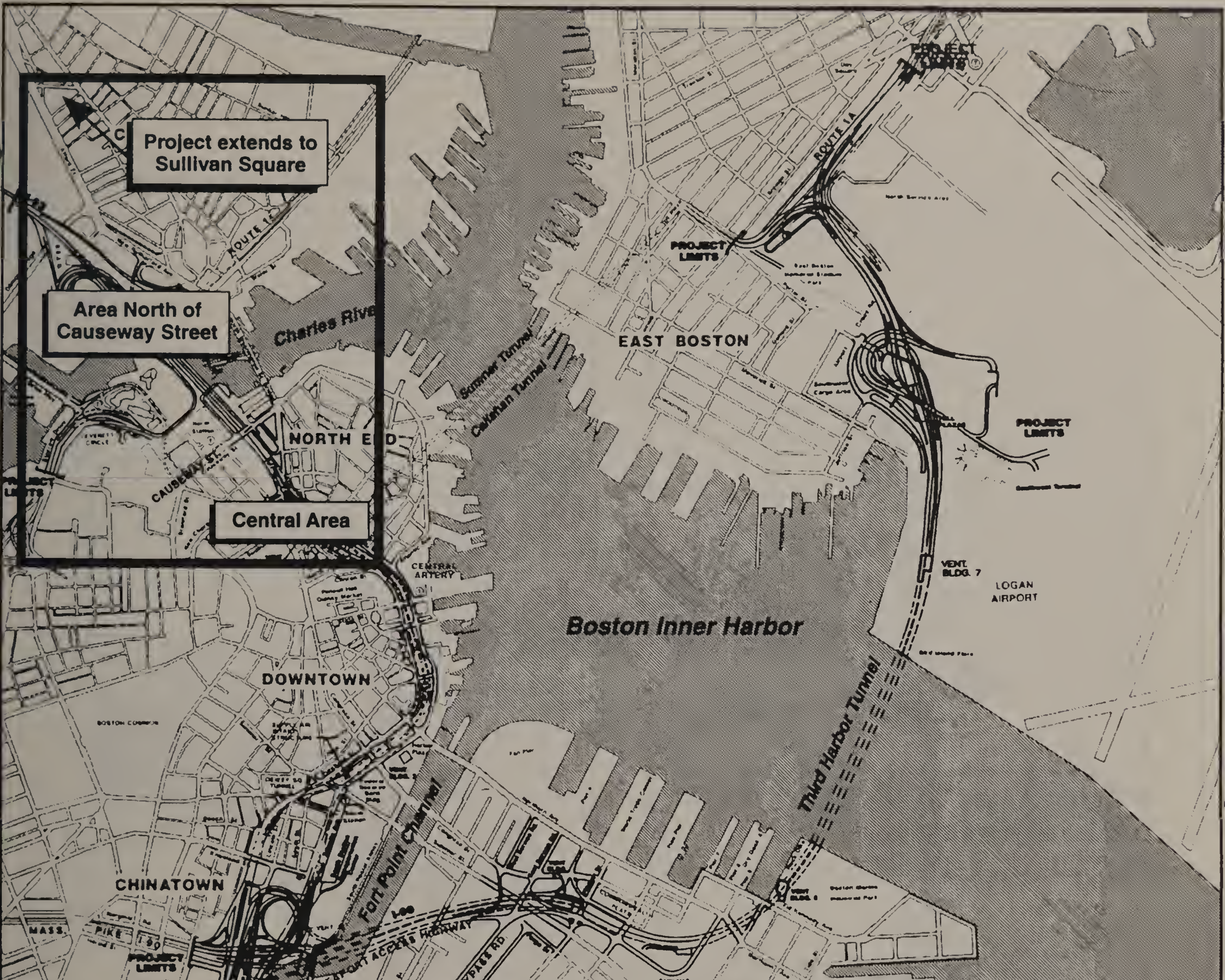
Scheme Z remains the Proposed Action for the Project in the Area North of Causeway Street until a new design for the Charles River Crossing is approved. If approved by FHWA in its Record of Decision to follow the public review period of this FSEIS/R, the Non-River-Tunnel Alternative as refined, and referred to as the Preferred Alternative in this FSEIS/R, will replace Scheme Z as the Proposed Action in the Area North of Causeway Street. Similarly, at the State level, MHD's findings following the Final Certificate on the FSEIS/R of the Massachusetts Secretary of Environmental Affairs will indicate the proponent's action with regard to the Preferred Alternative. The Preferred Alternative presented in this FSEIS/R, and described in detail in Section 2.1, reduces the environmental and aesthetic impacts of Scheme Z, while maintaining and increasing its level of improvement in regional traffic service.

The traffic operations provided by Scheme Z meet FHWA standards. The design was approved in concept during the 1991 environmental review process by agencies having jurisdiction over parkland, historic resource, and wetland issues, which constitute key environmental impact categories regarding the Charles River Crossing in this area. The aesthetic impacts of Scheme Z led MHD to engage in a process to develop a design that reduced these impacts and achieved a balance between environmental protective regulations and considerations of traffic capacity, safety, and aesthetics. This aim has guided the evaluation of several alternative designs as described in the 1993 DSEIS/R.

Traffic Operations And Safety. Efficient traffic flow and safety are primary Project objectives. The Preferred Alternative fulfills the transportation objectives and improves on the efficiency of Scheme Z. The inclusion of land-based tunnels in the North Station area provides direct access between the Central Artery and the Leverett Circle/Storrow Drive area, and reduces traffic volume on local streets. The inclusion of an HOV lane on I-93 southbound encourages efficient use of the regional highway system. In addition, a downtown on-ramp to I-93 northbound is included in the Preferred Alternative, which was not in Scheme Z.

Environmental And Aesthetic Impacts. A major focus in design development has been the reduction in the mass of Scheme Z's loop ramps, and their relocation away from the riverbank. On the north bank of the river, Scheme Z has six loop ramps rising to high elevations and close to the river's edge. The Preferred Alternative reduces this mass to three loop ramps which merge to two ramps, much lower in height, and removed from close proximity to the riverbank. The number of bridge structures is reduced from three bridges to two. The double-deck bridge of Scheme Z is eliminated and the number of lanes is reduced, resulting in narrower bridges of consistent profiles. Overall, the Preferred Alternative minimizes impacts of the Crossing on parklands, historic resources, and surrounding communities.

Cost. The cost of the Charles River Crossing was not a factor in evaluating the environmental impacts of the alternatives. Fiscal responsibility was considered in identification of the Preferred Alternative once the environmental impacts of the alternatives, as analyzed and documented in the environmental review process to date, proved to be substantially equivalent.


Project extends to Sullivan Square
Area North of Causeway Street
Central Area
Charles River
ROUTE 1
NORTH END
CAUSEWAY ST.
PROJECT LIMITS
PROJECT LIMITS
ROUTE 1A
PROJECT LIMITS
Sumner Tunnel
Callahan Tunnel
EAST BOSTON
PROJECT LIMITS
CENTRAL ARTERY
VENT. BLDG. 7
LOGAN AIRPORT
Boston Inner Harbor
DOWNTOWN
BOSTON COMMON
Third Harbor Tunnel
Fort Point Channel
CHINATOWN
MASS. PIKE I-90
PROJECT LIMITS
SEAPORT ACCESS HIGHWAY
I-93/I-90 INTERCHANGE
SOUTH BOSTON BYPASS RD
SOUTH BOSTON
SOUTH END
I-93 SOUTHEAST EXPRESSWAY
MASS. AVE. INTERCHANGE
PROJECT LIMITS
PROJECT LIMITS

FIGURE

1.1

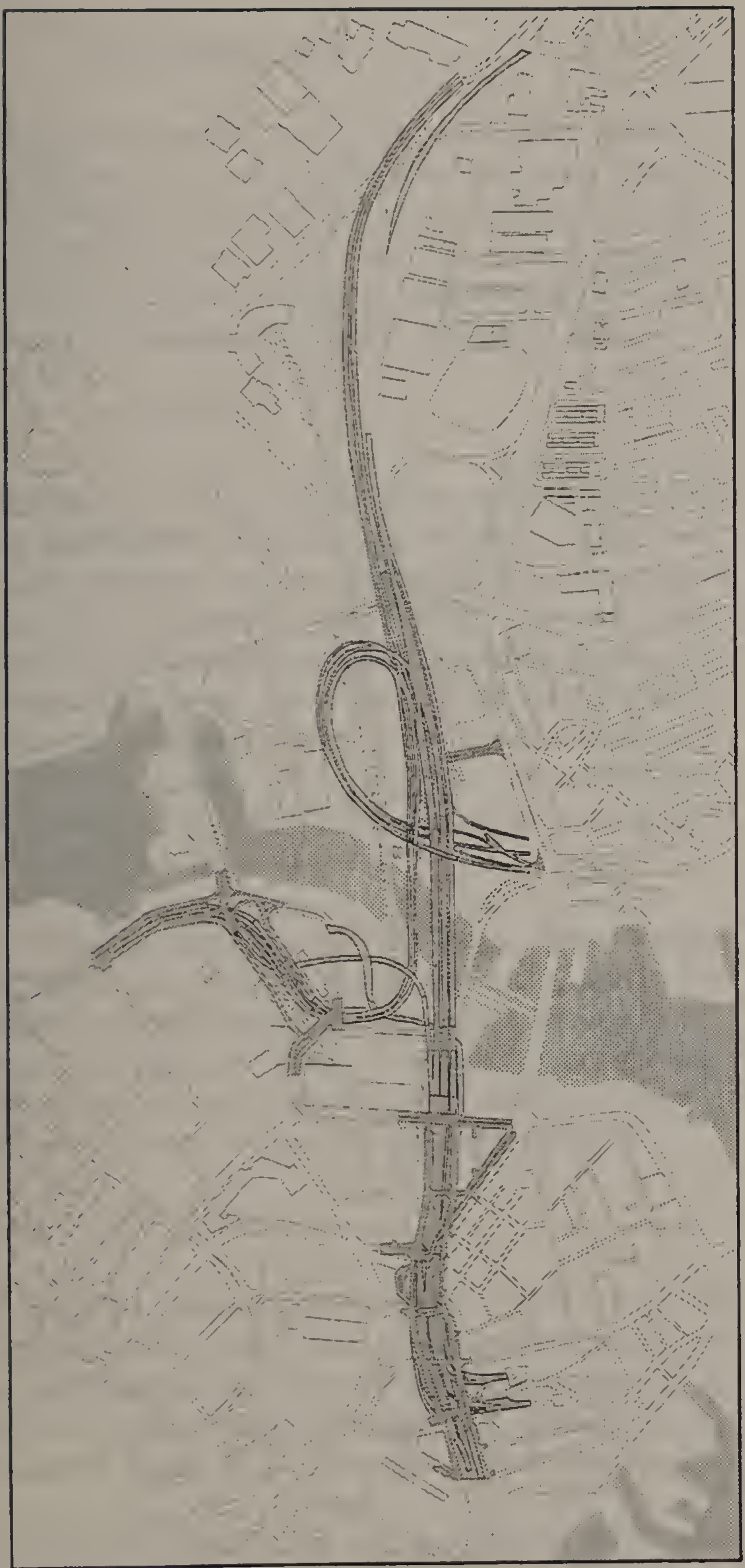
Area North Of Causeway Street In Relation To Central Artery/Tunnel Project

Charles River Crossing FSEIS/R

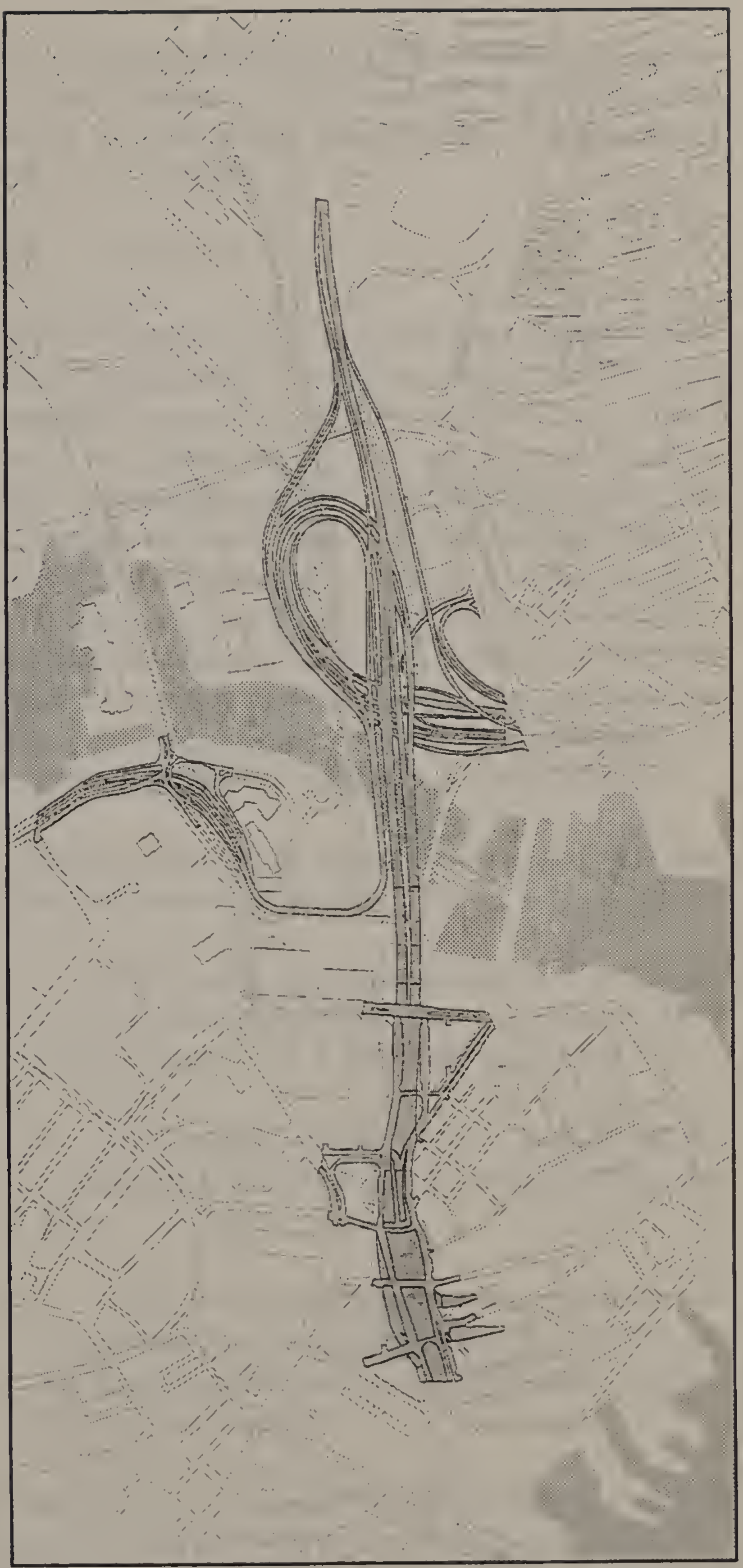
MASSACHUSETTS HIGHWAY DEPARTMENT

CENTRAL ARTERY/TUNNEL PROJECT

0 400 800 1600 2400 FEET



Preferred Alternative



Scheme Z

FIGURE

1.2

Preferred Alternative and Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not To Scale

1.4 BACKGROUND

This section summarizes information found in the 1986 FEIS/R and the 1991 FSEIS/R for the entire Central Artery/Tunnel Project, as well as the 1992 NPC and the 1993 DSEIS/R for the Charles River Crossing portion of it. These documents are incorporated by reference. Please refer to those documents for further details.

1.4.1 1986 FEIS/R

The Central Artery/Tunnel Project, to improve traffic flow in and around Boston, was proposed in 1983, and an environmental analysis was initiated in compliance with NEPA and MEPA. The FEIS/R recommended a Projectwide Preferred Alternative known as Alternative 5A Modified. It was approved by FHWA and the Massachusetts Executive Office of Environmental Affairs (EOEA) in January 1986. Fourteen issues remained unresolved in the 1986 FEIS/R, among them the design for the Charles River Crossing.

Between 1987 and 1990, MHD (then the Massachusetts Department of Public Works) considered 32 design alternatives for the Charles River Crossing portion of the Project: variations on bridge, river tunnel, and combinations of the two, and arrived at three families of design options that were evaluated in the 1991 FSEIS/R.

1.4.2 1991 FSEIS/R

The FSEIS/R, published in November 1990 and approved in January 1991, identified the three families of options for the Charles River Crossing. The design proposed in the 1991 FSEIS/R is an all-viaduct option, referred to as Scheme Z (originally known as Scheme Z Modified).

Although the FSEIS/R was approved by FHWA and EOEA, the final MEPA Certificate issued by the latter from the Secretary of Environmental Affairs strongly recommended further study of the Charles River Crossing because of environmental and aesthetic considerations and because of the public's reaction to Scheme Z. FHWA supported this additional study in its Record of Decision of May 1991.

In February 1991, a Bridge Design Review Committee was formed, consisting largely of representatives of affected communities and members of businesses and the design/planning professions. The BDRC was charged by the Secretary of Environmental Affairs with "identifying improvements in the Scheme Z crossing so as to make it as aesthetically pleasing and environmentally harmless as possible..."

1.4.3 1991 BDRC Process

With the support of the Massachusetts Executive Office of Transportation and Construction (EOTC) and independent experts, the BDRC identified and evaluated more than 20 alternatives. The options were based on bridge concepts designed to avoid parallel bridges with inconsistent profiles, to reduce overall bridge width, and to simplify the complexity of Scheme Z with its multiple decks and piers; and to reduce local traffic impacts. Additional concerns of the BDRC, which were included in their assessment of the design options, are described in the 1992 NPC, summarized in the 1993 DSEIS/R and are discussed in detail in Chapter 2 of this FSEIS/R.

The BDRC narrowed its recommendations to three Committee Improvement Packages (CIP):

- CIP 3, with three loop ramps in Cambridge, and a double-deck bridge over the Charles River with Storrow Drive connections on the top level
- CIP 5, with two loop ramps in Cambridge and a four-lane river tunnel for Storrow Drive connections
- CIP 8, a hybrid of the other two, with the northbound Storrow Drive connection in river tunnel, and the southbound connection on the bridge as part of the mainline crossing

In June 1991, the Committee indicated by a two-vote margin a slight preference for a variation of CIP 8 (8.1) over a variation of CIP 5 (5.3). After reviewing the features of CIP 8.1D Revisions 3, 4, and 5, it voted to recommend that CIP 8.1D Revision 5 proceed into the environmental review process as the Revised Charles River Crossing.

1.4.4 1992 Notice Of Project Change

An NPC was prepared by MHD for CIP 8.1D Revision 5, and filed with EOEA in September 1992. The design, known as Option (now Alternative) 8.1D Mod 5, was described, and differences from the Proposed Action's environmental impacts, construction period impacts, and permits and approvals were detailed. Several issues subject to further evaluation were identified.

In November 1992, FHWA published in the *Federal Register* a Notice of Intent to file an SEIS with the Environmental Protection Agency (EPA). During this period, MHD held several public meetings to present the Revised Charles River Crossing to residents and others affected by the design, and to abutters and special interest groups. The purpose was to receive their comments regarding the level of analysis to be included in the 1993 DSEIS/R.

1.4.5 1993 DSEIS/R

The FHWA Scope of Work for the DSEIS was issued February 12, 1993. It required the comparison of two design alternatives, a non-river-tunnel alternative and a reduced river-tunnel alternative, both refinements of Alternative 8.1D Mod 5. FHWA had previously expressed concerns in a letter dated January 26, 1993 about the costs and behavior risks associated with tunnels because of their impacts on driver behavior and on traffic operations and safety. USACE was concerned about 8.1D Mod 5's river tunnel impacts to water resources. The NPC Certificate (scope for the DSEIS/R) issued by EOEA on March 11, 1993, required MHD to develop similar additional alternatives because of concerns with traffic safety and operations and impacts on aquatic resources.

Two alternatives to Alternative 8.1D Mod 5, the Reduced River-Tunnel Alternative and the Non-River-Tunnel Alternative, are included in the DSEIS/R, along with Alternative 8.1D Mod 5 and the 1991 Proposed Action, Scheme Z.

The DSEIS/R did not identify a preferred alternative. It presented four designs, analyzed the environmental and construction period impacts of each, and compared them with each other. Several suggested design refinements of 8.1D Mod 5 and the Reduced River-Tunnel and Non-River-Tunnel Alternatives were also considered and summarized.

Summary Description Of Scheme Z And The Three New Design Alternatives

Scheme Z. Scheme Z features three bridge structures: two cable-stayed bridges with towers on both sides of the Charles River, and a double-deck bridge differing in type and profile from the main bridge. There are no tunnels or ventilation buildings. The two cable-stayed bridges, each with five lanes in one direction, accommodate the I-93 mainline, while the double-deck bridge (three lanes over three) accommodates traffic movements to and from Leverett Circle/Storrow Drive, for a total of 16 lanes over the river. Viaduct structures in East Cambridge provide connections to Storrow Drive and Charlestown. Some traffic movements (I-93 northbound to Storrow Drive, and Storrow Drive to I-93 southbound) require motorists to cross the river twice. The dominant features of this design are the large bridge structures which have inconsistent profiles and six nested loop ramps in East Cambridge.

Alternative 8.1D Mod 5. Alternative 8.1D Mod 5 includes a 10-lane cable-stayed mainline bridge with a single twin-legged tower on the north side of the river, a single loop ramp in East Cambridge, a three-lane northbound tunnel under the river, and land tunnels under East Cambridge, the North Station commuter railroad tracks, and the Registry of Motor Vehicles building. Over 10, 000 lf of structure are in tunnel, the greatest length of tunnel structure of any of the three new design alternatives. A ventilation building is required on the south side of the river to service the tunnel. I-93 mainline traffic crosses the Charles River on a single bridge with four lanes in each direction. An additional two lanes on the western side of the mainline bridge carry I-93/Route 1 southbound traffic to Leverett Circle/Storrow Drive, for a total of 10 lanes over the river. The North Station area tunnel portion accommodates traffic between I-93 and Storrow Drive, and the tunnel under the Charles River accommodates northbound traffic between Storrow Drive, I-93, and Route 1 (Tobin Bridge).

Reduced River-Tunnel Alternative. This design incorporates revisions of Alternative 8.1D Mod 5 which address FHWA concerns about Leverett Circle traffic operations and the operational and safety issues posed by travel in the proposed river tunnel. The I-93 to Route 1 (Tobin Bridge) movement is taken out of tunnel and placed on a viaduct structure by adding two lanes to the mainline bridge. This reduces the amount of tunnel travel by approximately 4,000 lf to 6,150 lf. The 12-lane mainline bridge (four lanes each north and south, two lanes on the western side of the mainline carrying I-93/Route 1 southbound traffic to Leverett Circle/Storrow Drive, and two lanes on the eastern side carrying traffic from downtown and the Sumner Tunnel to I-93 northbound) is supported by two towers, one on each side of the river. There are two loop ramps in East Cambridge, and a two-lane northbound tunnel under the Charles River (carrying traffic from I-93 northbound to Storrow Drive), with a ventilation building on the north side of the river. The land tunnels under the North Station commuter railroad tracks (carrying traffic from Storrow Drive to I-93 southbound) require one ventilation building on the south side of the river.

Non-River-Tunnel Alternative. The Non-River-Tunnel Alternative takes Storrow Drive-to-Tobin Bridge traffic out of tunnel and places it on viaduct, resulting in an additional 3,000 lf reduction in the amount of tunnel. There are three loop ramps, reducing to two loop ramps in East Cambridge, and a total of 14 lanes of traffic crossing the Charles River. The mainline bridge is a 10-lane cable-stayed structure with a tower on either side of the river. The mainline bridge features four lanes in each direction and an additional two lanes on its eastern side which carry downtown Boston and Sumner Tunnel traffic to I-93 northbound. A second bridge, which has the same profile as the mainline structure, carries an additional four lanes (two in each direction) to/from Storrow Drive/Leverett Circle. A total of 3,300 lf of highway remains in tunnel in the North Station area.

Following publication of the DSEIS/R in July 1993, community meetings were held in East Cambridge, and in the Charlestown and North Station areas of Boston. A public hearing was held at the Museum of Science on September 14, 1993. Comments received at this hearing , and those received by mail during the review and comment period, are summarized in Chapter 7 included in and Part II of this FSEIS/R. Based on a review of the comments and the results of the alternatives analyses in the DSEIS/R, the Non-River-Tunnel Alternative with certain design refinements was identified by the Secretary of the Massachusetts EOTC on November 16, 1993, as the Preferred Alternative for evaluation in this FSEIS/R.

1.5 ORGANIZATION OF THE FSEIS/R

The purpose of this FSEIS/R is to present the Preferred Alternative for the Charles River Crossing, the impacts associated with it, and the reasons for the choice of this design over the other designs assessed in the DSEIS/R.

The FSEIS/R is divided into two volumes, the main text and appendices. In Part I the following topics are presented, for the Area North of Causeway Street only:

- Immediately following the Summary is the Secretary of Environmental Affairs' Certificate on the DSEIS/R, including summary responses to its directives and references to section numbers in this report where more detailed information is found.

- Chapter 1 includes an introduction, a description of the purpose and need for the Project.

- Chapter 2 describes the Preferred Alternative, criteria used for its selection, and reasons for the rejection of the other designs (and of the refinements to them) that were considered in the DSEIS/R.

- Chapter 3 describes the Area North of Causeway Street: its existing conditions, neighborhoods and districts, existing transportation facilities, and proposed projects.

- Chapter 4 details the permanent long-term environmental impacts of the Preferred Alternative as compared with the original Proposed Action, Scheme Z, in terms of traffic and transportation; land use, including open space; air quality; noise and vibration; aquatic resources; threatened and endangered species; historic and archaeological preservation; hazardous waste sites; visual impacts; energy; the relationship of short-term uses versus long-term productivity; and irreversible and irretrievable commitment of resources. Mitigation measures are included by impact category.

- Chapter 5 identifies the temporary short-term impacts during construction of the Preferred Alternative as compared with Scheme Z. Mitigation measures are included by impact category.

- Chapter 6 summarizes the mitigation program, for permanent impacts, for the Area North of Causeway Street. The chapter features the comprehensive mitigation program for the New Charles River Basin.

- Chapter 7 presents a summary of the most frequently raised comments on the 1993 DSEIS/R and responses to them.

- Chapters 8 through 10 include required supplementary information.

- The Final Section 4(f) Evaluation is an independent document presenting impacts on parklands and historic resources, analysis of alternatives, and mitigation measures. It demonstrates that the Preferred Alternative minimizes harm to 4(f) resources. Appended to it is a copy of the Amendent and Restatement of the Memorandum of Agreement among EOTC, MHD, and MDC regarding the roles and responsibilities of implementing the New Charles River Basin mitigation program described in Chapter 6.

- The Index for Part I, including the Final Section 4(f) Evaluation, is located at the end of the document.

Part II contains the appendices, including letters received on the DSEIS/R and responses to them, and the Supportive Engineering Report. The Supportive Engineering Report contains more detailed technical information on the Preferred Alternative design in text and graphics than is found in the main body of the book.

2. Preferred Alternative

Chapter 2
PREFERRED ALTERNATIVE

The design selected for the Charles River Crossing portion of the Central Artery/Tunnel Project is referred to as the Preferred Alternative in this FSEIS/R. It is based on the Non-River-Tunnel Alternative, as described in the DSEIS/R of July 1993. Section 2.1 describes the Preferred Alternative, including design refinements incorporated since the DSEIS/R. For more detailed technical information and drawings on the Preferred Alternative, refer to the Supportive Engineering Report in Part II of this FSEIS/R. A complete description of the physical characteristics and environmental impacts of all of the design alternatives can be found in the 1993 DSEIS/R.

Section 2.2 describes the goals and objectives for the Charles River Crossing design, and includes discussion of the BDRC's goals and objectives. Section 2.3 sets forth how the Preferred Alternative satisfies these goals and objectives. Section 2.4 describes the features and reasons for rejection of each of the design alternatives (including suggested refinements) evaluated in the 1993 DSEIS/R. Section 2.5 summarizes the reasons why the Preferred Alternative represents the best balance of competing interests in the design selection process.

2.1 THE PREFERRED ALTERNATIVE

The Preferred Alternative (the Non-River-Tunnel Alternative) is one of two design alternatives developed in response to FHWA and agency comments on Alternative 8.1D Mod 5 as described in the September 1992 NPC. FHWA expressed concerns about operational and safety issues presented by the tightly curved tunnel design proposed for the south side of the Charles River in Alternative 8.1D Mod 5. USACE expressed concerns about the impacts of tunneling in the Charles River. Under the Preferred Alternative in this FSEIS/R, the Charles River Crossing is accomplished by land-based tunnels and bridge structures only, eliminating both the tunneling under the Charles River and the tightly curved tunnel roadway geometry associated with Alternative 8.1D Mod 5 (see Figure 2.1 for structures and 2.2 through 2.5 for main travel routes for the Preferred Alternative).

2.1.1 Description

The Preferred Alternative proposes an I-93 mainline bridge which is a long-span bridge consisting of ten lanes: four lanes each in northbound and southbound directions, and two lanes on a ramp cantilevered on the eastern side of the bridge to carry northbound traffic from downtown Boston and the Sumner Tunnel to I-93 northbound (see Figure 2.6 for an elevation of the long-span bridge). The Massachusetts Highway Department is committed to building a long-span signature bridge across the Charles River. It favors a cable-stayed structure as developed during the BDRC process. The bridge, as proposed, has a twin-legged tower on either side of the Charles River. FHWA will require a bridge type study analyzing long-span bridge alternatives to support that selection (see Figure 2.7 for examples of typical long-span bridges). It is possible that the bridge-type study may indicate that a modified tower design is needed due to engineering difficulties. However, these modifications could be incorporated without substantially altering the visual appearance of the cable-stayed structure. The graphics contained in this FSEIS/R are computer-generated renderings of this conceptual bridge design.

A second bridge, to the west of the mainline bridge and in the same basic profile, accommodates traffic between Leverett Circle/Storrow Drive and I-93 northbound and Route 1 northbound (Tobin Bridge). This bridge has four lanes, two each northbound and southbound (the Storrow Drive connector bridge). On the north bank of the Charles River, three loop ramps reduce to two in East Cambridge. These loop ramps have consistent profiles in the area along the riverbank and are set back a minimum of 120 feet from the north bank of the Charles River. Land-based tunnels pass under the commuter railroad tracks behind North Station to provide direct traffic connections between the Central Artery and the Leverett Circle/Storrow Drive area. These tunnels require one ventilation building south of the Charles River. The ventilation building is located north of and adjacent to the new Boston Garden site and the viaduct structures leading to the Storrow Drive connector bridge. It will be constructed below grade in order to maximize future development potential, with only the exhaust stacks and fresh air intake extending above grade.

2.1.2 Roadway Links

The following describes the six major traffic movements that are provided by the Preferred Alternative design:

- Tobin Bridge (Route 1) to Storrow Drive and I-93 southbound: Traffic heading south on Route 1 (Tobin Bridge) in Charlestown emerges from the CANA tunnels west of Rutherford Avenue, proceeds onto an elevated loop ramp, and then over the Charles River on viaducts and bridges. Local access is possible via connections at Leverett Circle. This movement requires one of the viaduct loop ramps located in East Cambridge. Local access to Rutherford Avenue and Charlestown is by an at-grade service road. Direct access to Boston Sand and Gravel Company (BSG) is provided from the at-grade service road via a signalized intersection.

- I-93 southbound to Storrow Drive: Traffic movements are provided on viaducts and bridges. Traffic diverges from the mainline in the Sullivan Square area, proceeds along a collector/distributor roadway, and crosses the Charles River on the Storrow Drive connector bridge, west of the mainline bridge. Local access is provided to East Cambridge, O'Brien Highway, and downtown Boston.

- I-93 northbound to Storrow Drive westbound: Traffic movements are provided through a land-based tunnel under the North Station area. Local connections are provided to East Cambridge and downtown Boston on the south side of the river at Leverett Circle and Nashua Street.

- I-93 northbound to Route 1 (Tobin Bridge): Traffic separates from the I-93 northbound mainline lanes onto a two-lane viaduct north of the Charles River. Access to Route 1 (Tobin Bridge) adds the second loop ramp to the interchange in East Cambridge. North of the Charles River, local access to Charlestown, Somerville, and Cambridge is provided at Cambridge Street, southwest of Sullivan Square. Local access from downtown Boston to I-93 northbound is provided at New Sudbury Street.

- Storrow Drive to I-93 southbound: Traffic movements are provided through a land-based tunnel under the North Station area from an at-grade intersection at Leverett Circle.

- Storrow Drive to I-93 northbound and Route 1 (Tobin Bridge) northbound: Traffic movements are provided in a new eastbound underpass beneath Leverett Circle and then over the Charles River on the Storrow Drive connector bridge. Access to Route 1 (Tobin Bridge) adds another partial loop ramp to the interchange in East Cambridge/Charlestown. Local on-ramps to I-93/Route 1 are provided at Leverett Circle.

2.1.3 Design Refinements Incorporated Into The Preferred Alternative Since The 1993 DSEIS/R

Since the 1993 DSEIS/R, five design refinements have been incorporated into the Preferred Alternative. The first three refinements were added either in direct response to comments received on the 1993 DSEIS/R or as a result of further design development. These three refinements also could have been applied to Alternative 8.1D Mod 5 or the Reduced River-Tunnel Alternative. This fact was considered in the selection of the Preferred Alternative.

The remaining two refinements were developed to further reduce or eliminate impacts associated with the Preferred Alternative. The fourth refinement was incorporated in order to avoid any impacts to the Nashua Street parkland parcel, a Section 4(f) parkland resource area. The fifth refinement was added to avoid a residential displacement.

2.1.3(a) Redesign Of Signalized Intersection At Millers River

FHWA expressed safety and driver expectancy concerns about the design of the at-grade intersection near the Millers River, as presented in the 1993 DSEIS/R for all of the new design alternatives. In particular, FHWA expressed concerns about the freeway-to-freeway regional traffic movements (i.e., I-93 to/from Route 1 [Tobin Bridge]) that were forced to stop at a signalized intersection which also accommodated local traffic movements.

In response to these concerns, the Preferred Alternative was revised to include a reconfiguration of the intersection (see Figure 2.8). The location of the intersection remains the same as previously shown (i.e., in the northern half of the Millers River, with the existing I-93 viaduct to the east and the BSG facility to the west). The new design provides for six turning movements, but

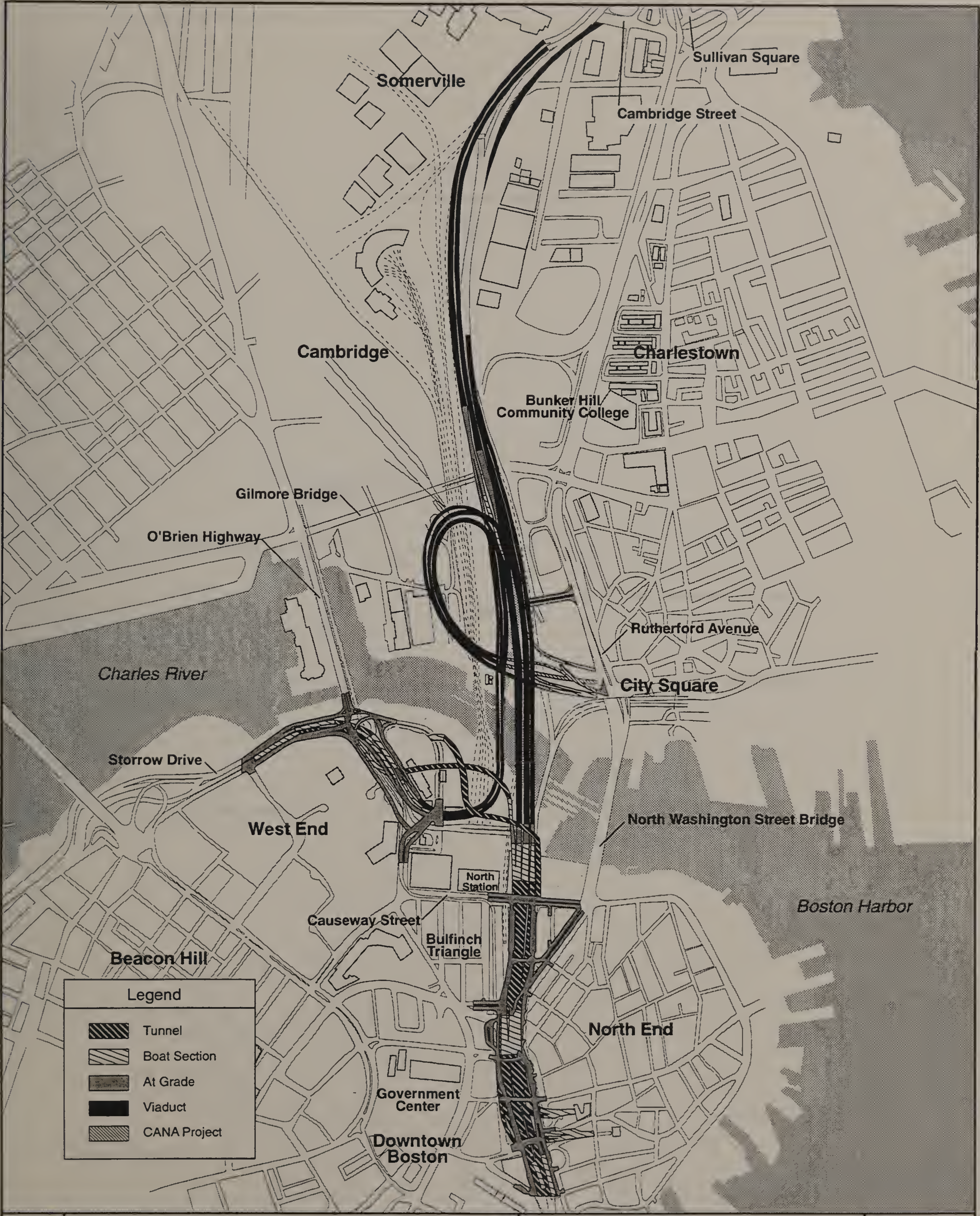
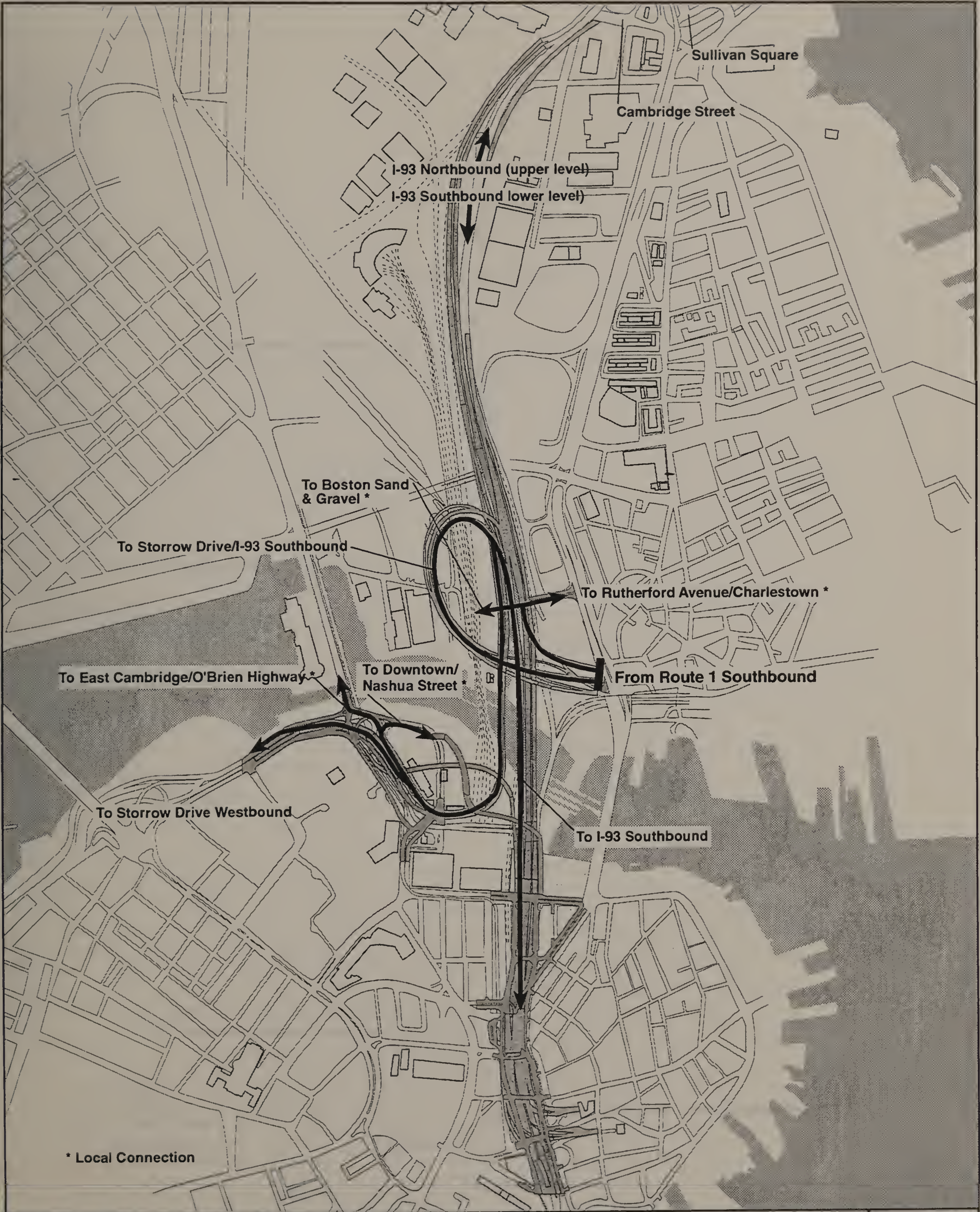

Sullivan Square
Somerville
Cambridge Street
Cambridge
Charlestown
Bunker Hill Community College
Gilmore Bridge
O'Brien Highway
Rutherford Avenue
Charles River
City Square
Storrow Drive
West End
North Washington Street Bridge
North Station
Boston Harbor
Causeway Street
Bulfinch Triangle
Beacon Hill
North End
Government Center
Downtown Boston
Legend
▨ Tunnel
▨ Boat Section
▨ At Grade
■ Viaduct
▨ CANA Project

FIGURE 2.1 Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET


Sullivan Square
Cambridge Street
I-93 Northbound (upper level)
I-93 Southbound lower level)
To Boston Sand & Gravel *
To Storrow Drive/I-93 Southbound
To Rutherford Avenue/Charlestown *
To East Cambridge/O'Brien Highway *
To Downtown/ Nashua Street *
From Route 1 Southbound
To Storrow Drive Westbound
To I-93 Southbound
* Local Connection

FIGURE

2.2

Travel Routes From Route 1 Southbound: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET

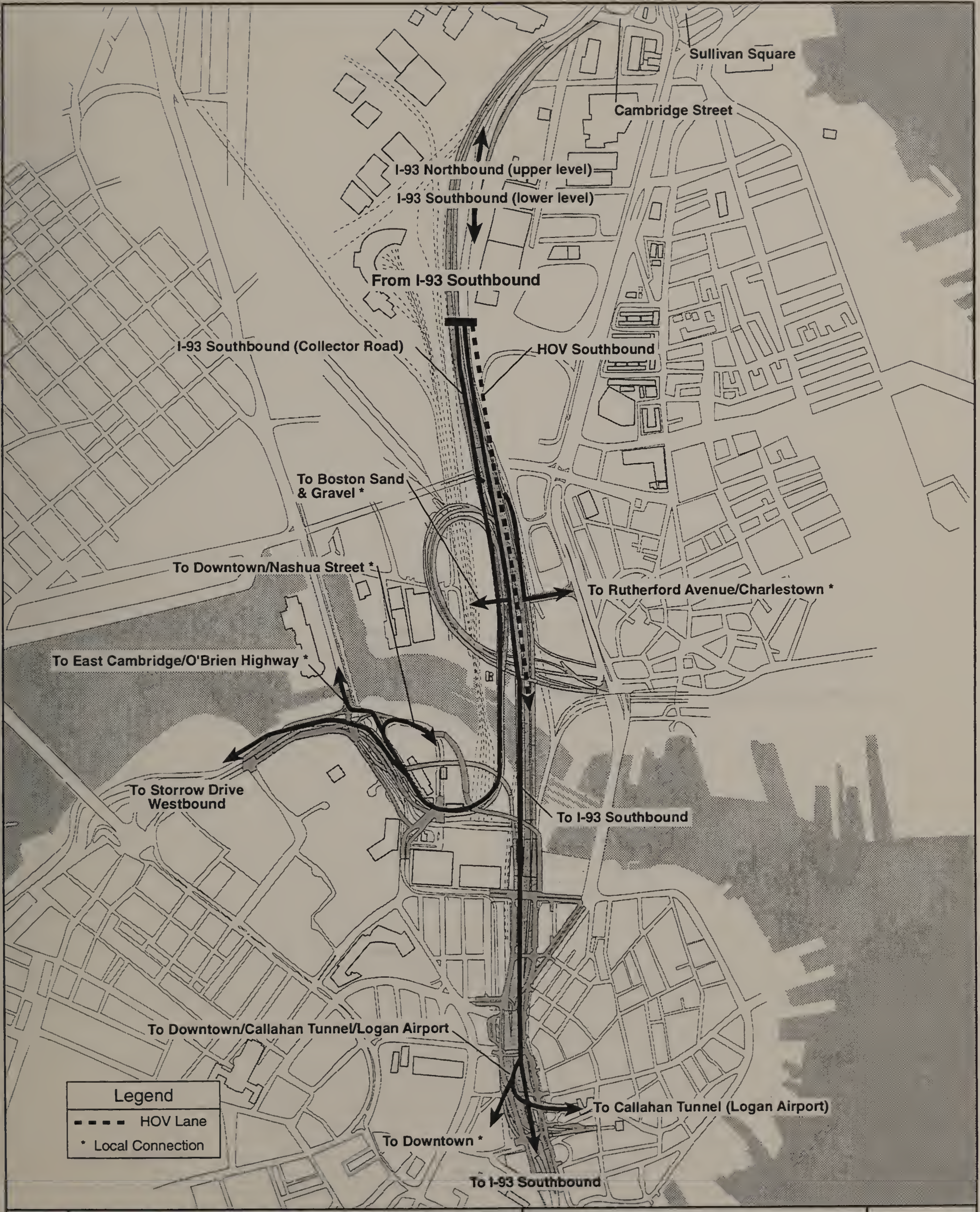

Sullivan Square
Cambridge Street
I-93 Northbound (upper level)
I-93 Southbound (lower level)
From I-93 Southbound
I-93 Southbound (Collector Road)
HOV Southbound
To Boston Sand & Gravel *
To Downtown/Nashua Street *
To Rutherford Avenue/Charlestown *
To East Cambridge/O'Brien Highway *
To Storrow Drive Westbound
To I-93 Southbound
To Downtown/Callahan Tunnel/Logan Airport
To Callahan Tunnel (Logan Airport)
To Downtown *
To I-93 Southbound
Legend
HOV Lane
* Local Connection
0
600
1400 FEET

FIGURE 2.3

Travel Routes From I-93 Southbound: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

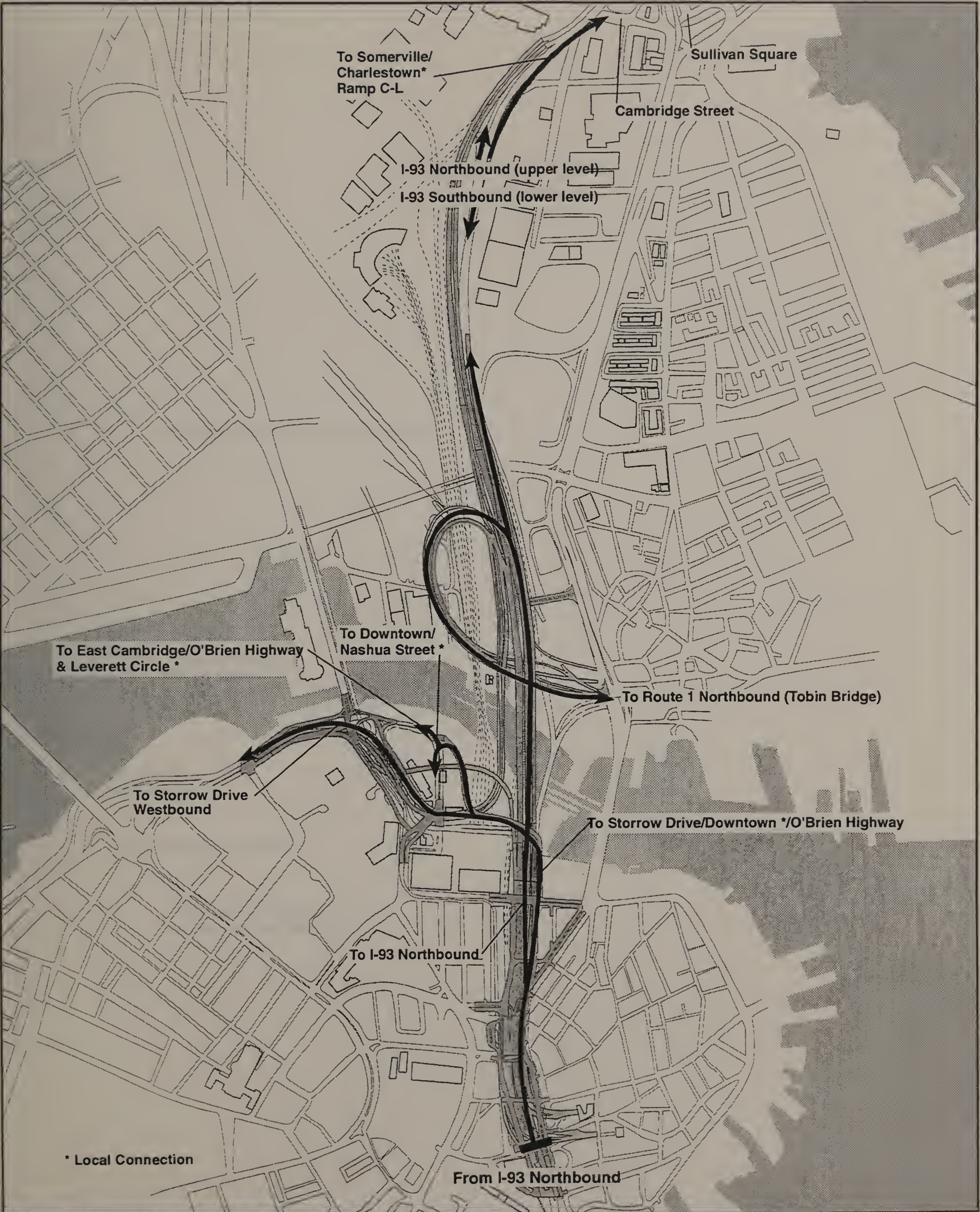

To Somerville/
Charlestown*
Ramp C-L
Sullivan Square
Cambridge Street
I-93 Northbound (upper level)
I-93 Southbound (lower level)
To East Cambridge/O'Brien Highway
& Leverett Circle *
To Downtown/
Nashua Street *
To Route 1 Northbound (Tobin Bridge)
To Storrow Drive
Westbound
To Storrow Drive/Downtown */O'Brien Highway
To I-93 Northbound
From I-93 Northbound
* Local Connection

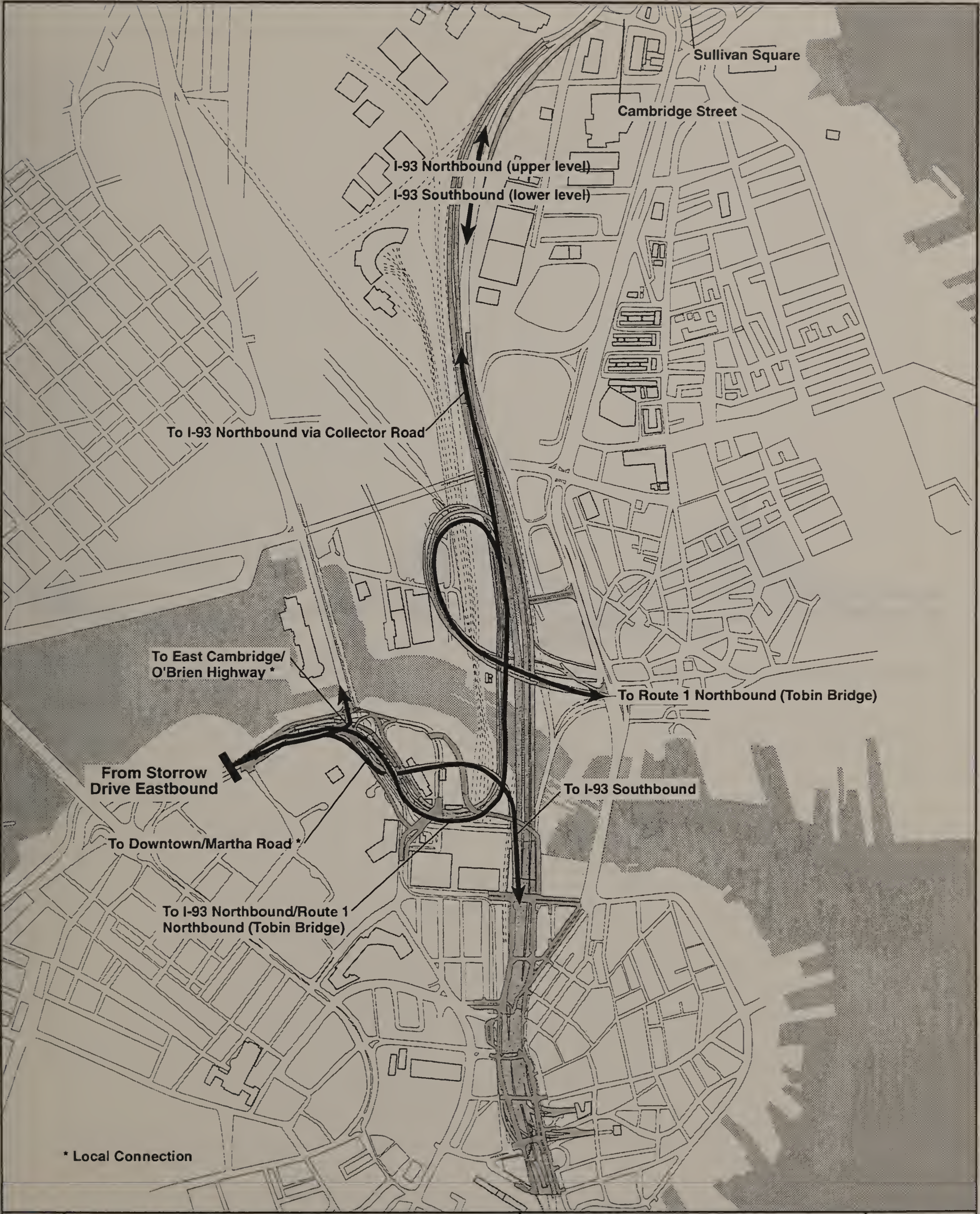
FIGURE
2.4

Travel Routes From
I-93 Northbound:
Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET


Sullivan Square
Cambridge Street
I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound via Collector Road
To East Cambridge/
O'Brien Highway *
To Route 1 Northbound (Tobin Bridge)
From Storrow
Drive Eastbound
To I-93 Southbound
To Downtown/Martha Road *
To I-93 Northbound/Route 1
Northbound (Tobin Bridge)
* Local Connection
0
600
1400 FEET

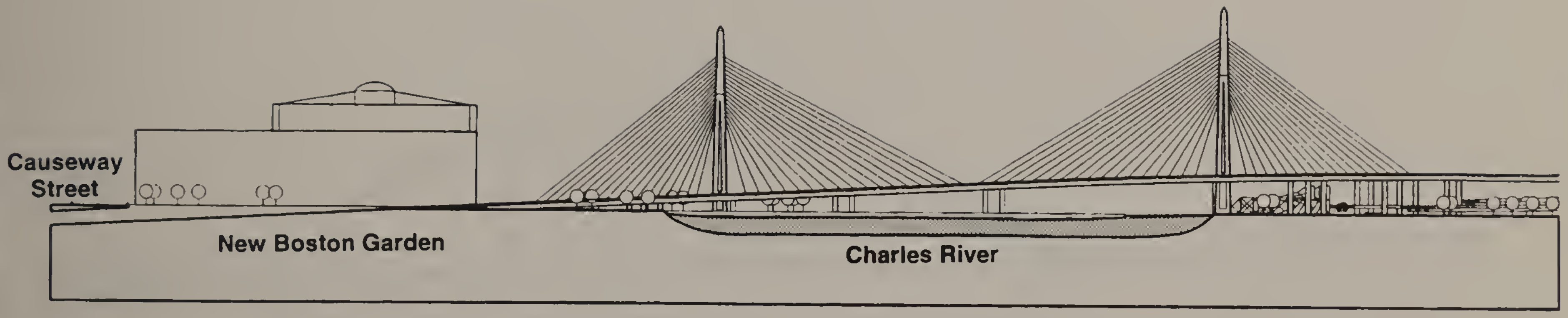
FIGURE

2.5

Travel Routes From Storrow Drive Eastbound: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Causeway Street
New Boston Garden
Charles River

Preferred Alternative

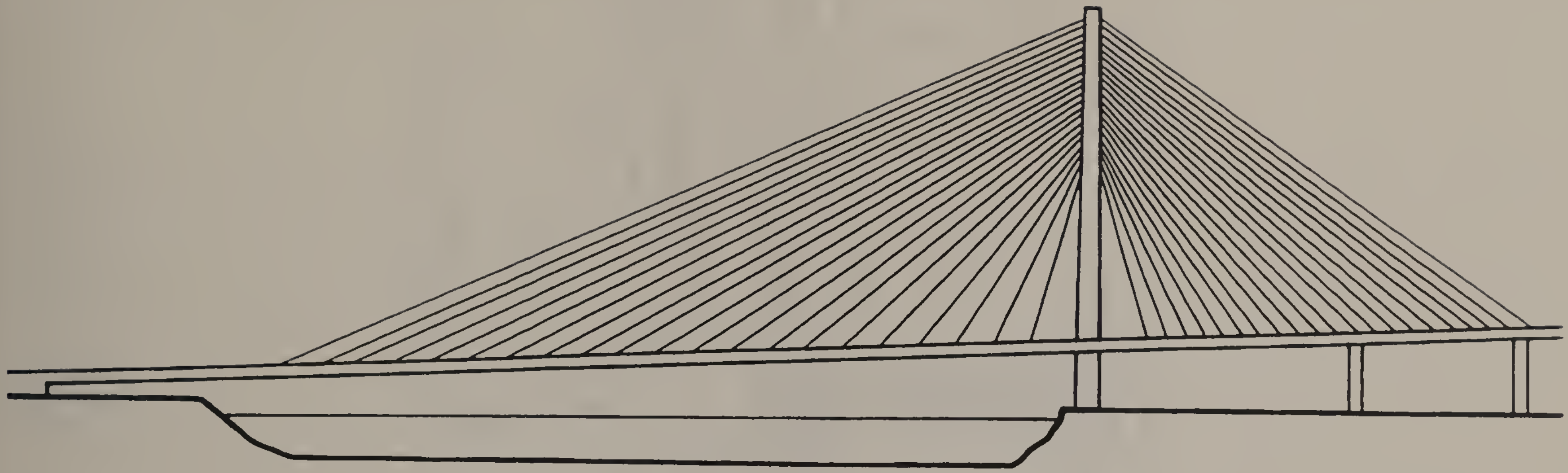
FIGURE

2.6

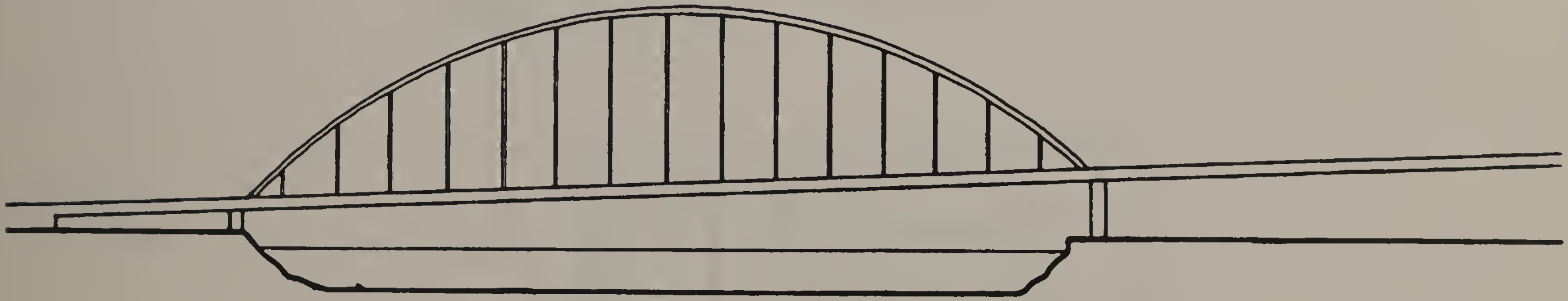
Elevation Looking West of Preferred Alternative: Long Span Bridges

Charles River Crossing FSEIS/R

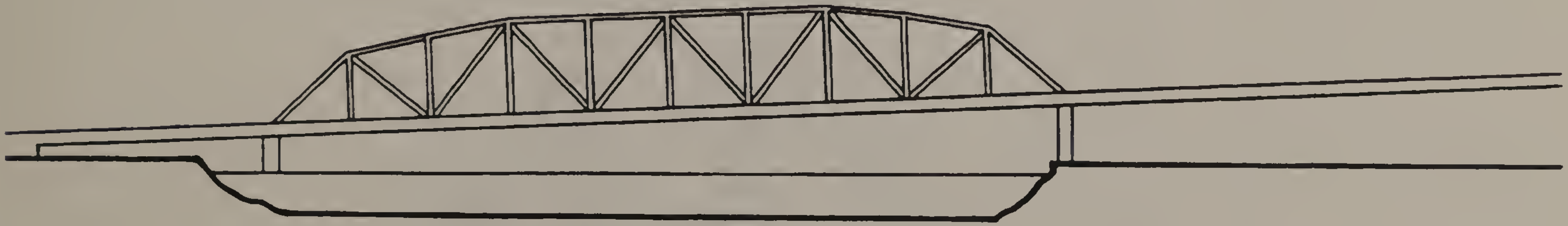
MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT



Cable-Stayed Bridge (Single Tower Option Shown)



Tied-Arch Bridge



Long-Span Truss Bridge

FIGURE

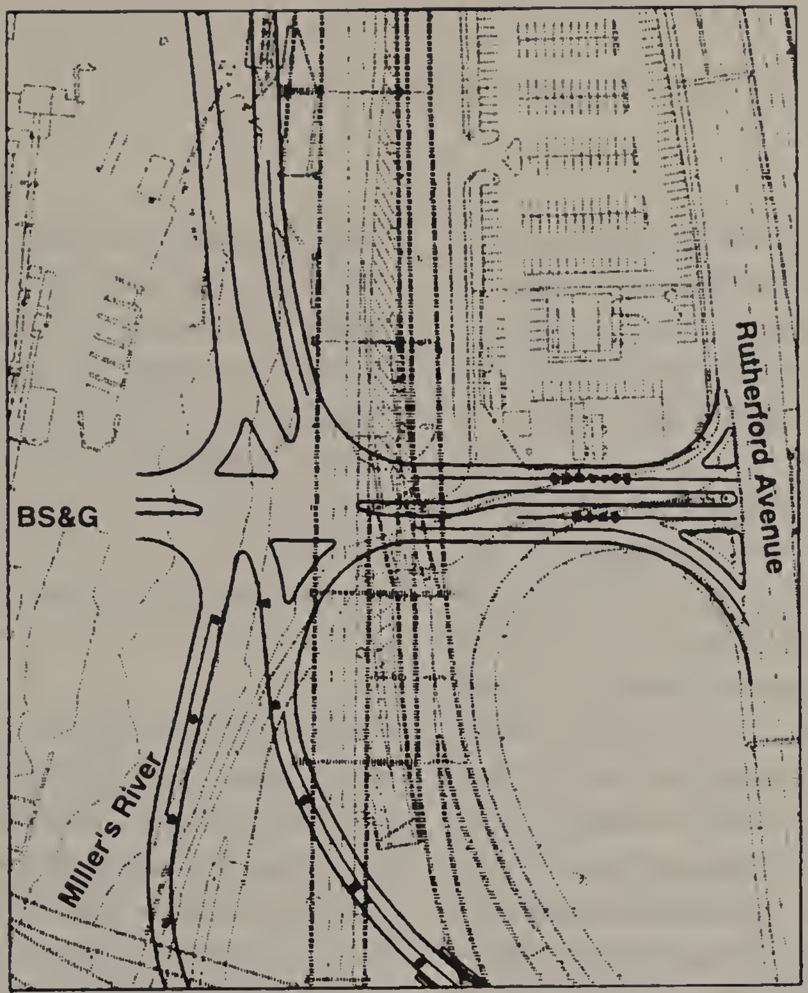
2.7

Elevations Of Typical Long-Span Bridges

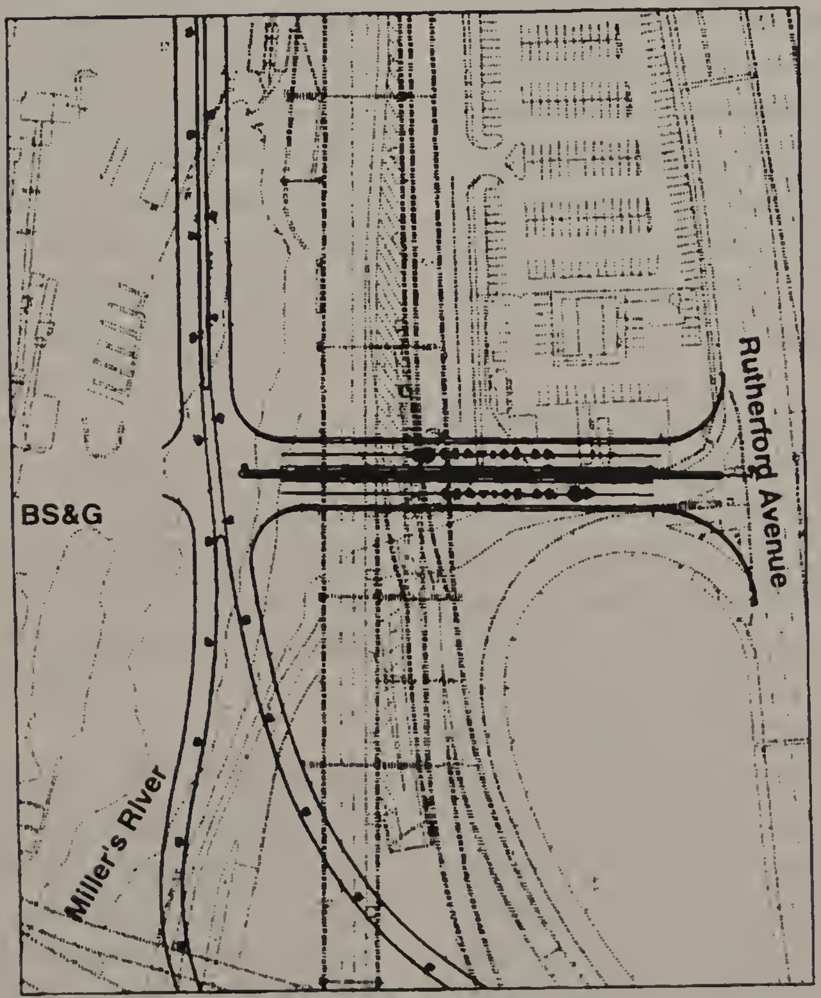
Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale


Rutherford Avenue
BS&G
Miller's River

Preferred Alternative


Rutherford Avenue
BS&G
Miller's River

Non-River-Tunnel Alternative

FIGURE

2.8

Design Refinement: Redesign Of Signalized Intersection At The Millers River

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

NOT TO SCALE

eliminates the two freeway-to-freeway connections. These connections represent indirect routes of travel (i.e., traffic coming from areas north of Boston and travelling south over the Tobin Bridge to reach I-93 northbound); therefore, these moves attract low peak hour volumes which can be accommodated efficiently on alternative routes.

Travel movements provided at the reconfigured intersection are as follows:

- Southbound from I-93: Traffic on I-93 southbound destined for either Rutherford Avenue, City Square, or Route 1 southbound (Storrow Drive) diverges from I-93 southbound at the existing Sullivan Square stub. The traffic then continues south along the west side of the existing mainline via a separate, single-deck, two-lane elevated structure. Approximately 600 feet north of the existing Gilmore Bridge, traffic transitions from elevated to surface level, passing underneath the existing Gilmore Bridge as an at-grade roadway. About 300 feet farther south, traffic diverges: connections to Storrow Drive (Route 1 southbound) on the right, and connections to Rutherford Avenue/City Square on the left. Traffic heading for Rutherford Avenue continues to the at-grade signalized intersection. At the intersection, traffic turns left and continues on a two- to three-lane service road which intersects Rutherford Avenue, or right to access BSG.

- Southbound from Route 1: Approximately 200 feet after emerging from the CANA tunnel, traffic travelling from Route 1 southbound stops at the signalized intersection and turns right onto the service road and then to Rutherford Avenue, or left onto the service road and then to BSG.

- From Rutherford Avenue: All traffic from Rutherford Avenue destined for the Tobin Bridge, I-93 northbound, or BSG travels along the 450-foot two-way, two- to three-lane service road between Rutherford Avenue and the signalized intersection at the ramp entrance. Traffic destined for I-93 northbound turns right at the intersection. Traffic heading for the Tobin Bridge turns left at the intersection. Traffic destined for BSG proceeds straight through the intersection.

- From Boston Sand and Gravel: As in the previous at-grade intersection design, access to/from BSG improves over the existing condition. Trucks from BSG can now directly access Rutherford Avenue via the two-way service road, as well as I-93 northbound, and Route 1 northbound (Tobin Bridge).

2.1.3(b) Realignment Of Ramp C-L To Sullivan Square Area

Ramp C-L (the ramp carrying northbound traffic from the Central Artery to local destinations) allows access from I-93 northbound to Charlestown via Rutherford Avenue. Ramp C-L, as shown in the 1993 DSEIS/R for each of the new design alternatives, curves to the right over the athletic fields of Bunker Hill Community College. These recreational fields are considered a Section 4(f) parkland resource. The ramp then meets Rutherford Avenue approximately 200 feet south of A Street. Objections to this ramp alignment were voiced by the College, several abutters, and community residents in comments on the 1993 DSEIS/R. In addition to the impact on the athletic fields, community members commented that the location of the ramp in this area could adversely impact traffic operations on Rutherford Avenue. Traffic projections, however, indicate that levels of service at this intersection would be acceptable. Nonetheless, in response to parkland concerns, the Preferred Alternative now relocates Ramp C-L farther north to the Sullivan Square area with a terminus at Cambridge Street in Charlestown (see Figure 2.9).

Relocating Ramp C-L to Cambridge Street affords the opportunity to eliminate the slip ramp from I-93 northbound to Ramp SA-CN in the vicinity of Causeway Street. Instead, I-93 northbound and Ramp SA-CN continue across the Charles River as four and two lanes, respectively. North of the Gilmore Bridge, Ramp SA-CN joins I-93 northbound. The resulting auxiliary lane, approximately 1,800 feet in length, provides sufficient weaving distance between this on-ramp and the newly relocated exit ramp, Ramp C-L. At this point, I-93 northbound continues as three lanes as two lanes diverge right to Ramp C-L. At the end of this ramp, traffic can turn right on Cambridge Street to Sullivan Square/Charlestown or turn left on Cambridge Street to Somerville and Cambridge. The design of this refinement will continue to be coordinated with the City of Boston (Boston Transportation Department) and the affected community. Improvements to the Sullivan Square area will be developed in accordance with the results of a comprehensive study by MHD of Rutherford Avenue, including Sullivan Square and its approaches.

2.1.3(c) Single-Deck I-93 Collector/Distributor Road

The Preferred Alternative incorporates the design of the collector/distributor roadway as a single-deck structure instead of a stacked ramp structure as shown in the 1993 DSEIS/R. The purpose of this refinement is to improve the vertical geometry of the roadway and to simplify the structural design (see Figure 2.10). This refinement could also be applied to any of the new design alternatives evaluated in the 1993 DSEIS/R.

The northbound collector road carries traffic from Storrow Drive and Rutherford Avenue in Charlestown to I-93 northbound. Traffic from Rutherford Avenue joins traffic from Storrow Drive just south of the Gilmore Bridge. This two-lane ramp passes under the Gilmore Bridge and then rises to clear the existing MBTA commuter railroad tracks as it continues northward to the west of the existing I-93 structure. To join I-93, the collector road connects into an existing northbound stub near Sullivan Square.

The southbound collector road carries traffic from I-93 southbound to Storrow Drive and Rutherford Avenue/ Charlestown. This two-lane viaduct begins at the existing I-93 southbound stub in the Sullivan Square area and continues south along the west side of I-93. North of the Gilmore Bridge it transitions to the surface and passes under the bridge. The roadway then splits to allow one lane to rise and join traffic heading south on the Storrow Drive connector bridge over the Charles River, while the other lane carries traffic to the at-grade signalized intersection at the Millers River. Once there, traffic can turn left onto the service road to Rutherford Avenue/Charlestown or turn right to access the BSG facility.

2.1.3(d) Realignment Of Ramp CN-L (I-93 Northbound To Nashua Street)

In the Preferred Alternative, Ramp CN-L has been realigned to avoid the Nashua Street parkland parcel along the south bank of the Charles River. The new Ramp CN-L is a right-hand exit from the two-lane land-based tunnel carrying traffic from I-93 northbound to the Storrow Drive/Leverett Circle area. The one-lane exit tunnel ramp transitions into two lanes as it begins to surface. As the transition section comes to grade, it meets existing Nashua Street. There is a stop condition for vehicles turning left onto existing Nashua Street. Horizontal and vertical alignment restrictions exist; however, the ramp design meets 25 mph Project Design Criteria (see Figure 2.11).

This realignment of Ramp CN-L was described in the 1993 DSEIS/R as a refinement to the Non-River-Tunnel Alternative. The realigned Ramp CN-L not only avoids use of a 4(f) parkland resource (Nashua Street Park), it also avoids the need to realign existing Nashua Street. (There is a need to realign a short segment of the south end of Nashua Street. See Subsection 2.1.3(e) below.) As a result of the new Ramp CN-L alignment, the proposed ventilation building 8 has been relocated farther south, adjacent to the proposed viaduct ramps and the tunnel leading from I-93 northbound to Storrow Drive.

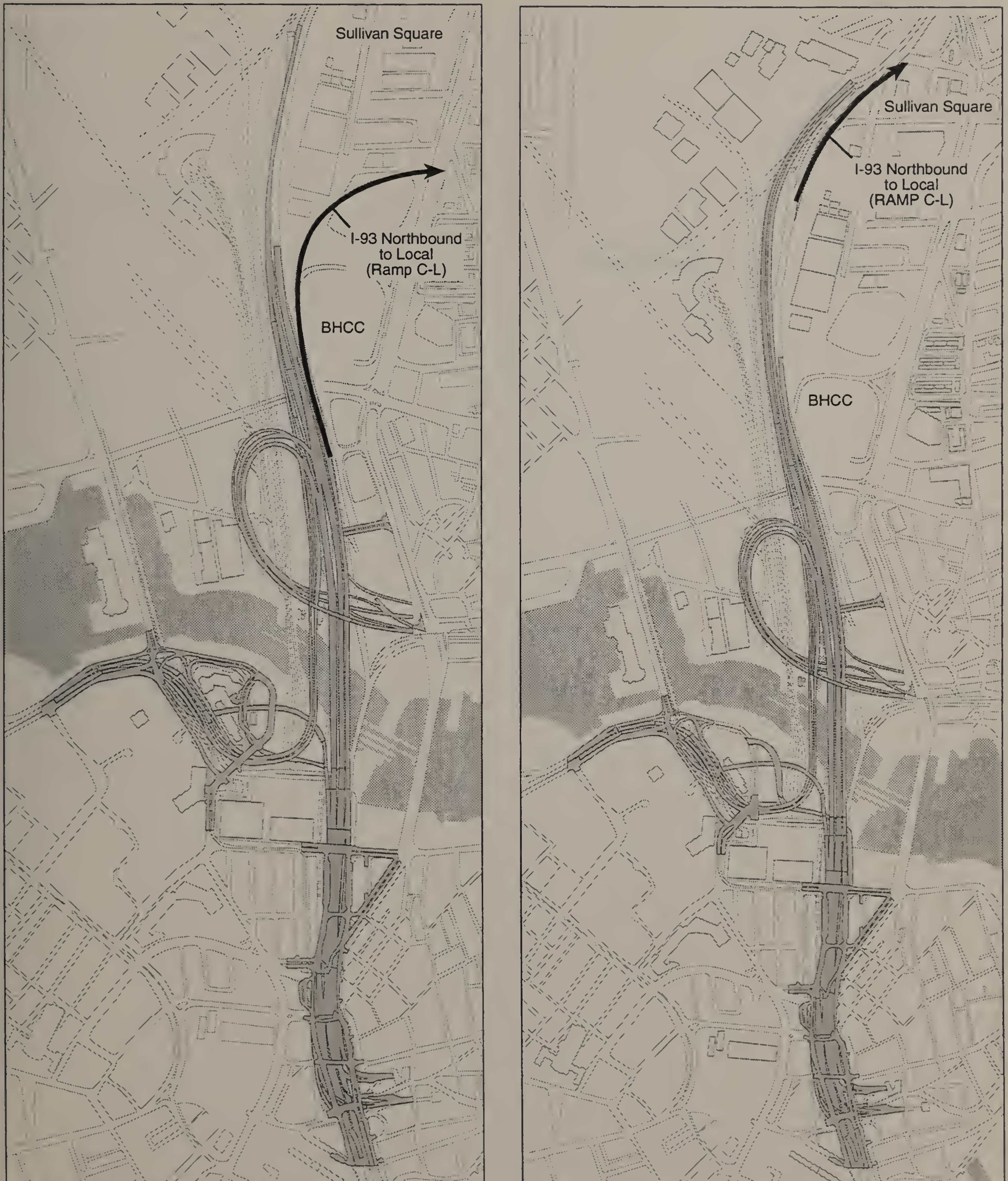
2.1.3(e) Realignment Of Nashua Street

The Preferred Alternative includes a short realignment of the south end of Nashua Street to avoid displacing a single residential building in the Lomasney Way/Lowell Square area (see Figure 2.12). This is consistent with a Project commitment to avoid displacing residential structures. The realignment provides two lanes in both directions. The realigned portion extends only between existing Nashua Street near the eastern end of the Registry building and the recently reconstructed Lomasney Way at the southwest corner of the O'Neill Federal Office Building. Connections are provided to the existing entrance/exit ramps to the new MBTA underground parking garage below the new Boston Garden arena, both under construction. This area is relatively level and, therefore, the proposed profile grades allow adequate access to the adjacent parcels. Since planned MBTA projects and other development proposals for this area may affect this structure, this realignment will continue to be evaluated as conditions warrant.

2.2 GOALS AND OBJECTIVES FOR THE CHARLES RIVER CROSSING DESIGN

2.2.1 MHD Transportation And Environmental Goals And Objectives

MHD's planning for the Charles River Crossing was guided by the transportation and environmental objectives outlined in Section 1.3 of this FSEIS/R. In summary these objectives are:


Sullivan Square
I-93 Northbound to Local (Ramp C-L)
BHCC
Sullivan Square
I-93 Northbound to Local (RAMP C-L)
BHCC

Non-River-Tunnel Alternative

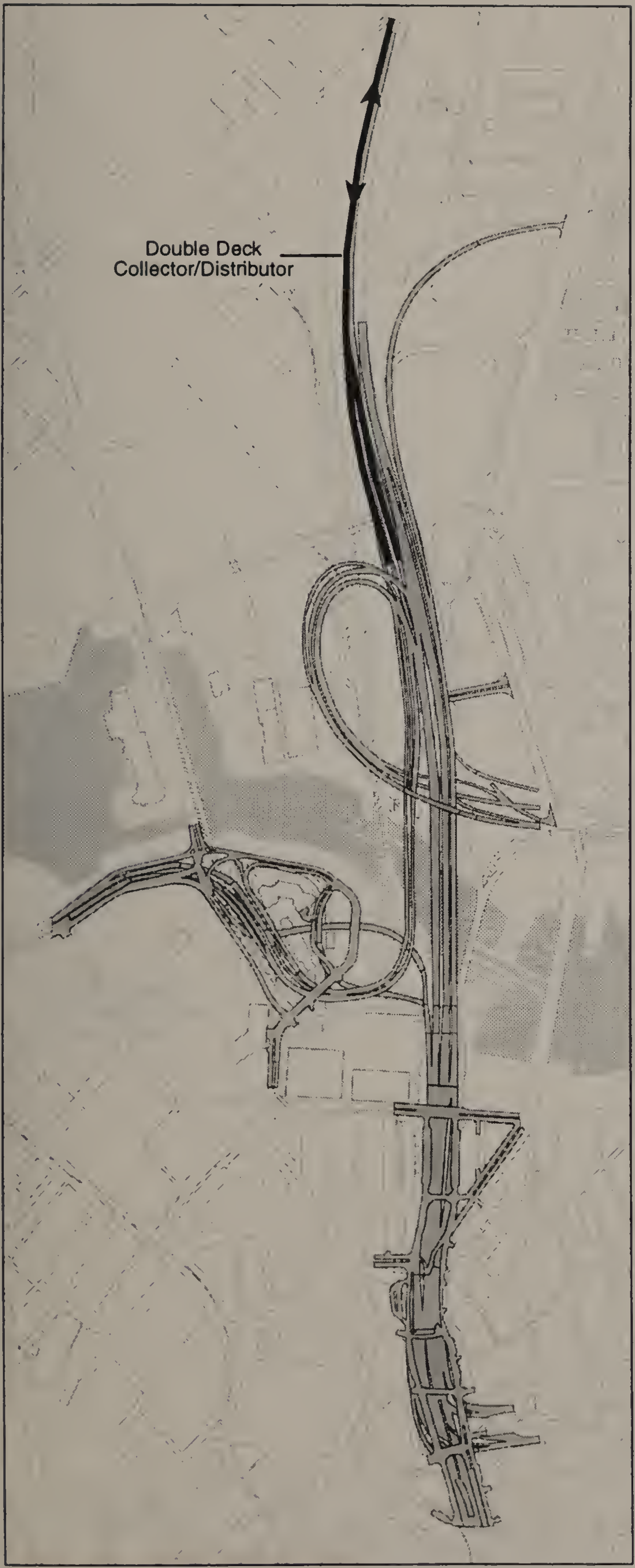
Preferred Alternative

FIGURE 2.9

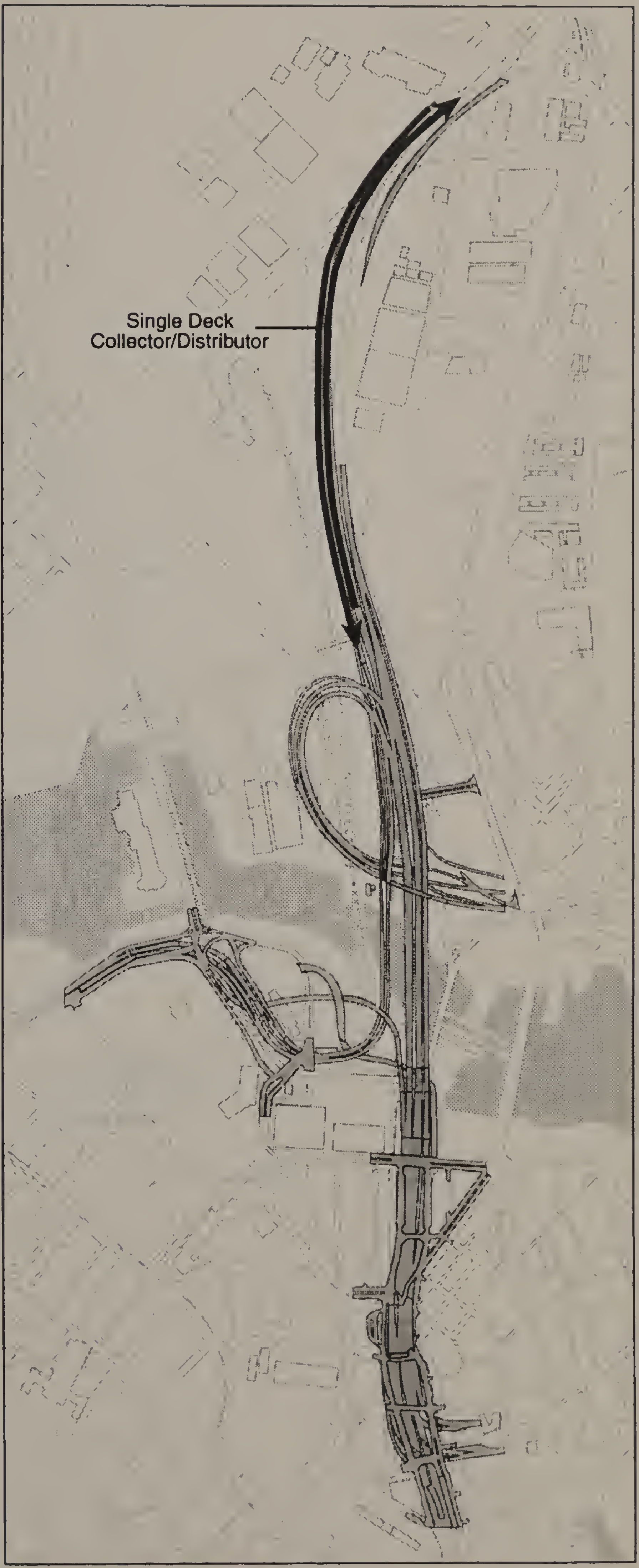
Design Refinement: Realignment Of Ramp C-L To Sullivan Square Area

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Double Deck
Collector/Distributor

Non-River-Tunnel Alternative


Single Deck
Collector/Distributor

Preferred Alternative

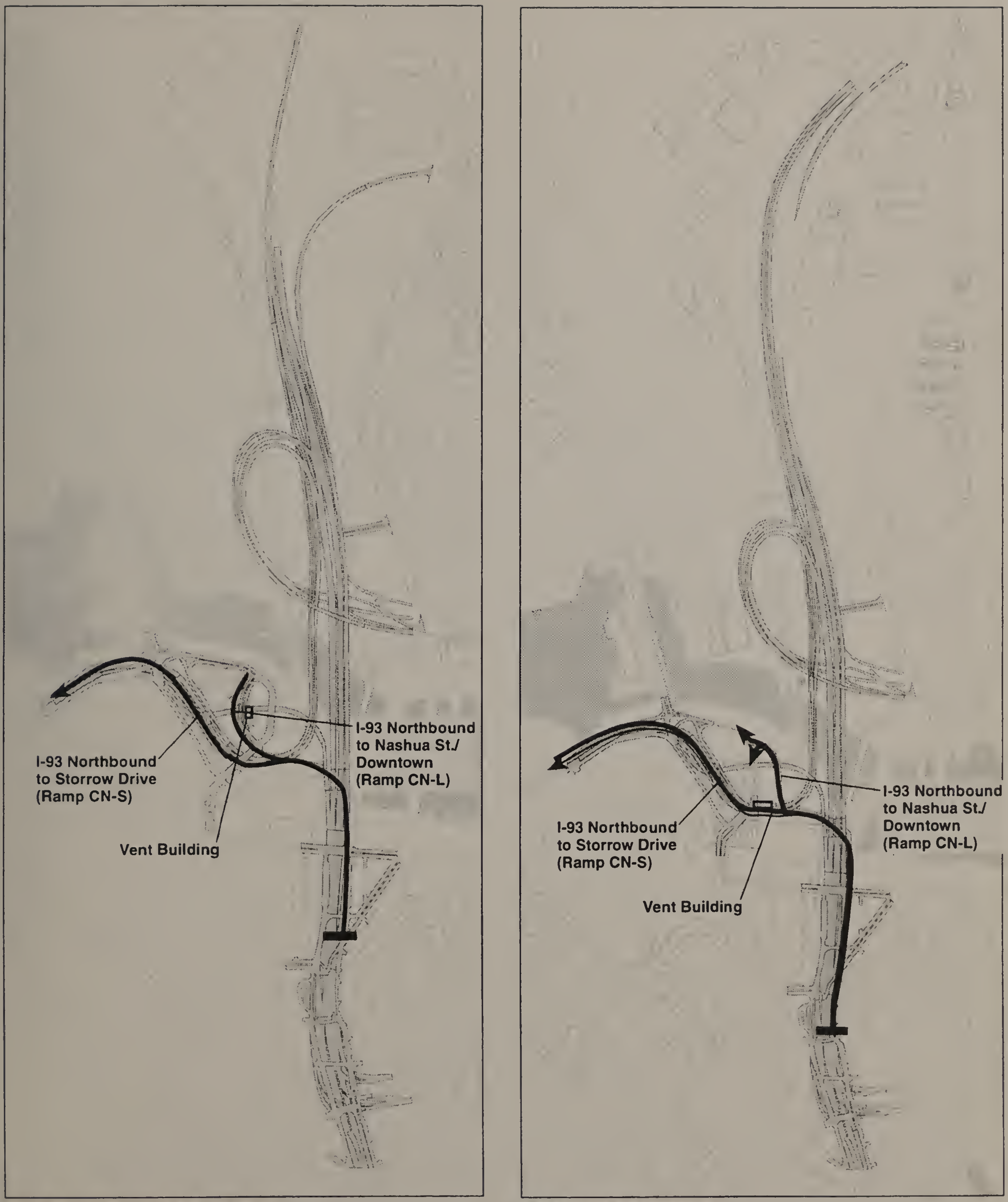
FIGURE

2.10

Design Refinement: Single-Deck I-93 Collector/Distributor Road

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


I-93 Northbound
to Storrow Drive
(Ramp CN-S)
Vent Building
I-93 Northbound
to Nashua St./
Downtown
(Ramp CN-L)
I-93 Northbound
to Storrow Drive
(Ramp CN-S)
Vent Building
I-93 Northbound
to Nashua St./
Downtown
(Ramp CN-L)

Non-River-Tunnel Alternative

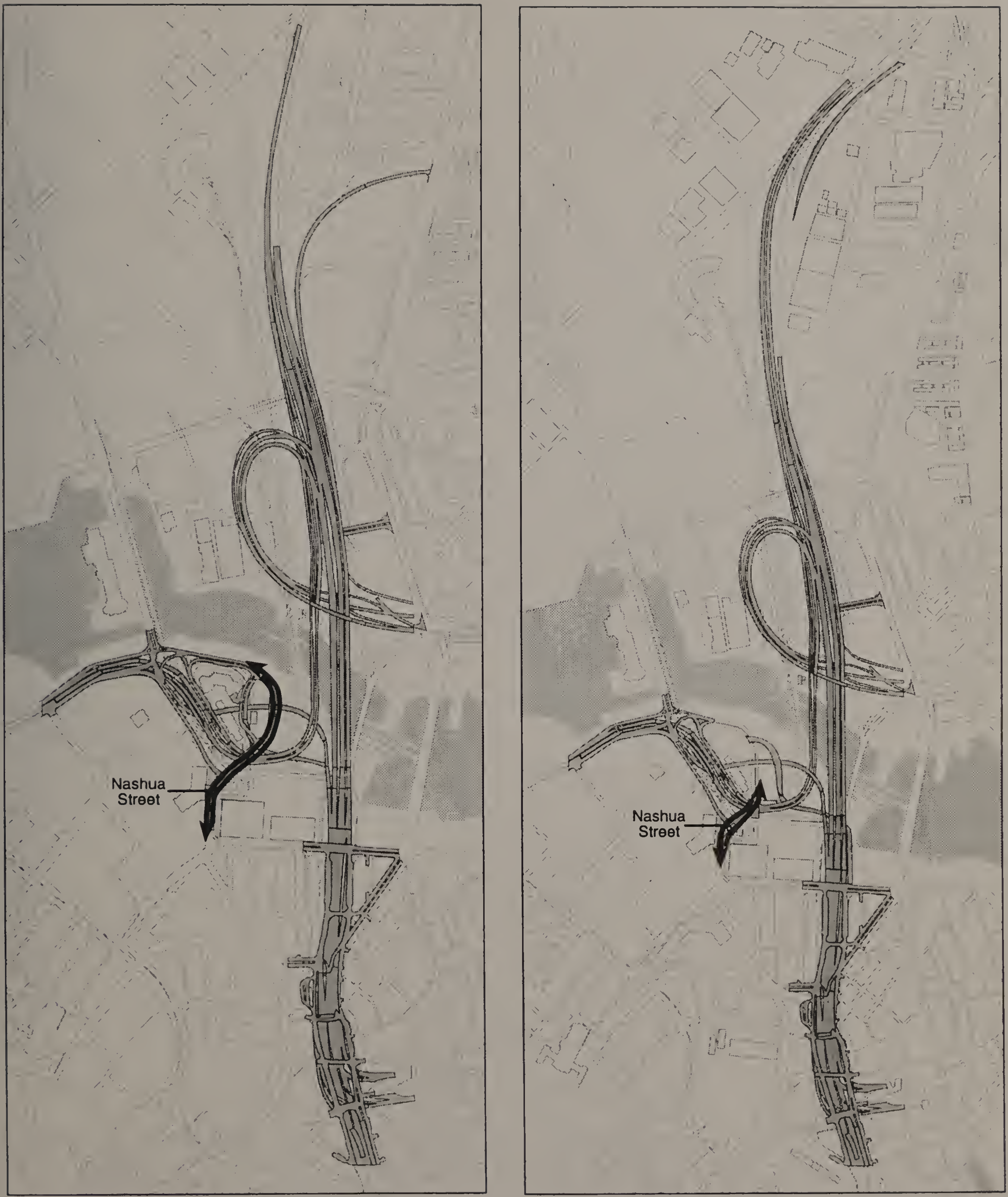
Preferred Alternative

FIGURE

2.11 Design Refinement:
Realignment Of Ramp CN-L

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Nashua Street
Nashua Street

Non-River-Tunnel Alternative

Preferred Alternative

FIGURE

2.12 Design Refinement:
Realignment Of Nashua Street

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Traffic Operations And Safety.

- Achieve efficient and safe highway operations.
- Improve essential regional roadway connections.
- Achieve efficient operations on the local roadway network and provide critical connections to highway sections.
- Provide compatibility with other proposed transportation improvements.

Environmental And Aesthetic Impacts.

- Minimize impacts to natural environmental resources such as wetlands and other aquatic resources.
- Meet applicable national and State ambient air quality requirements.
- Avoid or minimize impacts to parkland, historic, and archaeological resources.
- Minimize impacts to the adjacent communities.
- Minimize Project materials disposal requirements.

Scheme Z, the Proposed Action in the 1991 FHWA Record of Decision (ROD), was developed based on a thorough review of these objectives and detailed evaluations of environmental impacts. Even though Scheme Z satisfied the transportation and environmental objectives of the Project within the environmental regulatory framework, the height and mass of its physical structures led to the call for further examination of the Charles River Crossing design. The 1991 Certificate of the Secretary of the Executive Office of Environmental Affairs (EOEA) requested the formation of the BDRC. The BDRC identified additional goals and objectives for the Charles River Crossing design that have been used in the subsequent development of the three new design alternatives presented in the 1993 DSEIS/R.

2.2.2 Goals And Objectives Of The BDRC

The result of the then Secretary of Environmental Affairs' request for the formation of a committee to review ways "to improve the environmental and aesthetic impacts of the Charles River Crossing" was to expand the objectives of an already complex Charles River Crossing design. The BDRC, acting as an advisory group to the Secretary of EOTC, identified a series of concerns about the Scheme Z design, established a number of goals and objectives for satisfying these concerns, and set out a series of technical studies to help redefine the Charles River Crossing. These goals and objectives were instrumental in the BDRC's development of Alternative 8.1D Mod 5. While MHD gave serious consideration to Alternative 8.1D Mod 5 and based its 1992 NPC on this alternative, ultimately 8.1D Mod 5 was not selected, primarily due to safety and operational concerns and potential environmental impacts associated with its tunnel design (see Section 2.4 for discussion of reasons for rejection). The goals and objectives identified by the BDRC were, however, incorporated into the Project's overall goals and objectives for the Charles River Crossing and weighed heavily in the identification of the Preferred Alternative.

The goals and objectives of the BDRC, as summarized in its final report published June 1991, are as follows:

- Reduce visual impacts of bridge and ramp height/massing to improve visual design.
- Restore the Traverse Street on-ramp or an equivalent move to reduce additional traffic on local streets and reduce adverse noise and air quality impacts.
- Ensure positive development/design of parkland along the Charles River Basin, which is adversely affected by Scheme Z.
- Investigate alternative schemes, including partial and /or full tunnel alternatives, to find a superior solution to a river crossing.
- Reduce negative impact of bridge piers and overhead structures on aquatic resources and navigation in the Charles and Millers Rivers and on open space along their banks.
- Incorporate/improve non-automobile transportation, including pedestrian and bicycle routes, ferry service at Lovejoy Wharf, and bus and HOV routes.
- Provide pedestrian and bicycle routes along both

banks of the Charles River and connections both to and across the river from Charlestown, Cambridge, and Boston.

- Maintain/review all connections to the regional roadway system. Give special consideration to the role played by Storrow Drive in the regional system and maintain its character as part of the Esplanade.

- Minimize construction impacts; maintain road and transit connections during construction.

The BDRC goals are generally consistent with the Project's transportation objectives (e.g., to improve essential regional roadway connections); however, they broaden the objectives of the Charles River Crossing design, giving greater emphasis to environmental and aesthetic considerations. This broadening of objectives reinforces the need for careful balancing of competing interests to achieve the best overall balance of operational, environmental, and aesthetic considerations, consistent with MHD and BDRC goals and objectives for selection of the Preferred Alternative.

2.3 ROLE OF PROJECT GOALS AND OBJECTIVES IN THE IDENTIFICATION OF THE PREFERRED ALTERNATIVE

2.3.1 Overview

The identification of a Preferred Alternative marks the culmination of a 3-year effort to improve the Charles River Crossing design. Section 2.2 summarizes the development of the goals and objectives that have guided the design of alternatives for the Crossing. As was stated previously, Scheme Z satisfied those objectives when it was designated the Proposed Action in 1991. Subsequently, the goals and objectives were expanded by the BDRC, and three new design alternatives, each superior to Scheme Z, were developed and evaluated in the 1993 DSEIS/R. Based upon the evaluation of alternatives in the 1993 DSEIS/R, it is apparent that while each design alternative satisfies the transportation and environmental goals and objectives to a greater or lesser extent, no one alternative can be identified as clearly superior in all categories. A balancing of interests is required to select a preferred alternative. The comments of the Secretary of EOEA in the MEPA Certificate on the 1993 DSEIS/R are particularly appropriate:

> "[I]t appears that environmental impacts will not be the determinative factor in the selection of a preferred alternative. ...[T]he main reason is that the combined environmental impacts are the same or similarly significant in each of the three scenarios. Furthermore, to the extent one alternative offers a clear advantage in one area, it frequently increases adverse impacts in another area...."

The MEPA Certificate also notes that the selection of a Preferred Alternative "remains the responsibility of the EOTC and the Massachusetts Highway Department."

The remainder of this section demonstrates how the Non-River-Tunnel Alternative (with certain refinements), as the Preferred Alternative, satisfies the goals and objectives set forth in Section 2.2.

2.3.2 Consistency Of The Preferred Alternative With Project Objectives

The selection of the Preferred Alternative is based on satisfying the transportation and environmental goals and objectives adopted by MHD and augmented through the efforts of the BDRC. The transportation and environmental goals and objectives established by MHD are presented in Section 2.2. The discussion below demonstrates how the specific objectives are satisfied through the selection of the Preferred Alternative.

Traffic Operations And Safety.

- Achieve efficient and safe highway operations: The Preferred Alternative minimizes the number of interchange connections which are located within tunnel sections and simplifies the overall design. As a result of this simplification, the Preferred Alternative has the lowest expected accident rate of the alternatives studied.

- Improve essential regional roadway connections: The Preferred Alternative maintains and improves the essential connections to the regional roadway system, as described in detail in Section 2.1.2.

- Achieve efficient operations on the local roadway network and provide critical connections to highway sections: Traffic operations and flow patterns are improved as traffic is shifted from local streets to the regional highway system, the double crossing of the Charles River is eliminated, and downtown Boston access to I-93 northbound is restored with the New Sudbury Street ramp.

- Provide for compatibility with other proposed transportation improvements: The Preferred Alternative is compatible with proposed highway, transit, rail, and water transport improvements. The design does not impede development of a rail connection between North Station and South Station and an extension of intercity passenger rail service northward, and it includes an HOV facility from the northern boundary of the Project to approximately the north bank of the Charles River on the I-93 southbound mainline. This facility is compatible with future HOV expansion options.

Environmental And Aesthetics.

- Minimize impacts to natural environmental resources such as wetlands and other aquatic resources: While the structures of the Preferred Alternative require some filling of wetlands regulated by Federal and State standards, this filling is required under all of the new design alternatives. Filling of wetlands is minimized to the extent feasible under the Preferred Alternative, which fills a portion of the Millers River, a degraded remnant of a water body. This filling of the Millers River allows the loop ramps to be set back from the north bank of the Charles River. The Preferred Alternative avoids potential adverse construction period impacts to navigation, the operation of the Charles River Dam, and water quality which could result from construction of a river tunnel.

- Meet national and State ambient air quality requirements: The elimination of the "double river crossing" set forth in Scheme Z, results in lower vehicle miles travelled (VMT), thereby producing lower levels of carbon monoxide (CO) emissions with the Preferred Alternative.

- Avoid or minimize impacts to parkland, historic, and archeological resources: By reducing the height and mass of highway structure, proximity impacts to the Section 4(f) parkland resources in the New Charles River Basin are reduced; the harm to overall parkland resources is minimized; more immediate development of parklands is possible; and earlier fulfillment of the MDC master plan for the extension of the Charles River Reservation is enabled. Improvement of the riverfront park/open space system is facilitated through the expansion of Paul Revere Landing Park North and through substantially improved pedestrian connections along the north and south banks of the Charles River.

- Minimize impacts to the adjacent communities: Visual impacts are reduced and parkland development opportunities benefiting neighboring communities are improved and can be implemented earlier. Also, the potential for future joint development is highest with the Preferred Alternative. While minimizing construction impacts, the Preferred Alternative maintains road and transit connections during construction, minimizes construction impacts in the Charles River, has no net impact on North Station commuter railroad services, and does not constrain the proposed North Station/South Station rail link. The construction duration is 8.5 years, similar to that of Scheme Z which is 2 to 4.5 years shorter than the other alternatives studied.

- Minimize Project materials disposal requirements: The volume of dredged and excavated materials to be disposed of, though greater than with Scheme Z, is moderate, less than 0.5 million cubic yards since only land-based tunneling will be required.

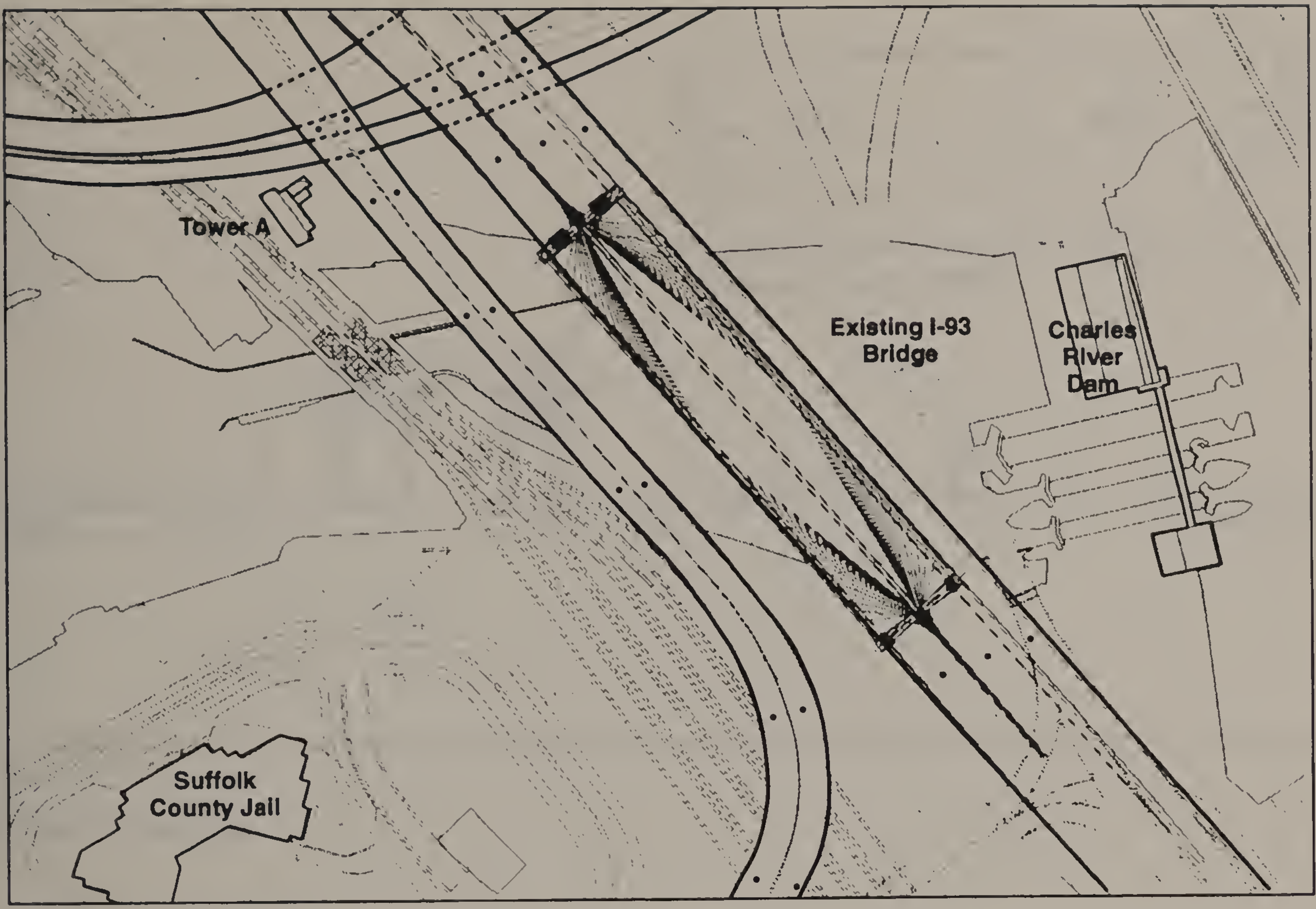
In addition, USACE used its own regulatory criteria to make its preliminary determination that the Preferred Alternative constitutes its Least Environmentally Damaging Practicable Alternative (LEDPA).

2.3.3 Consistency Of The Preferred Alternative With BDRC Goals

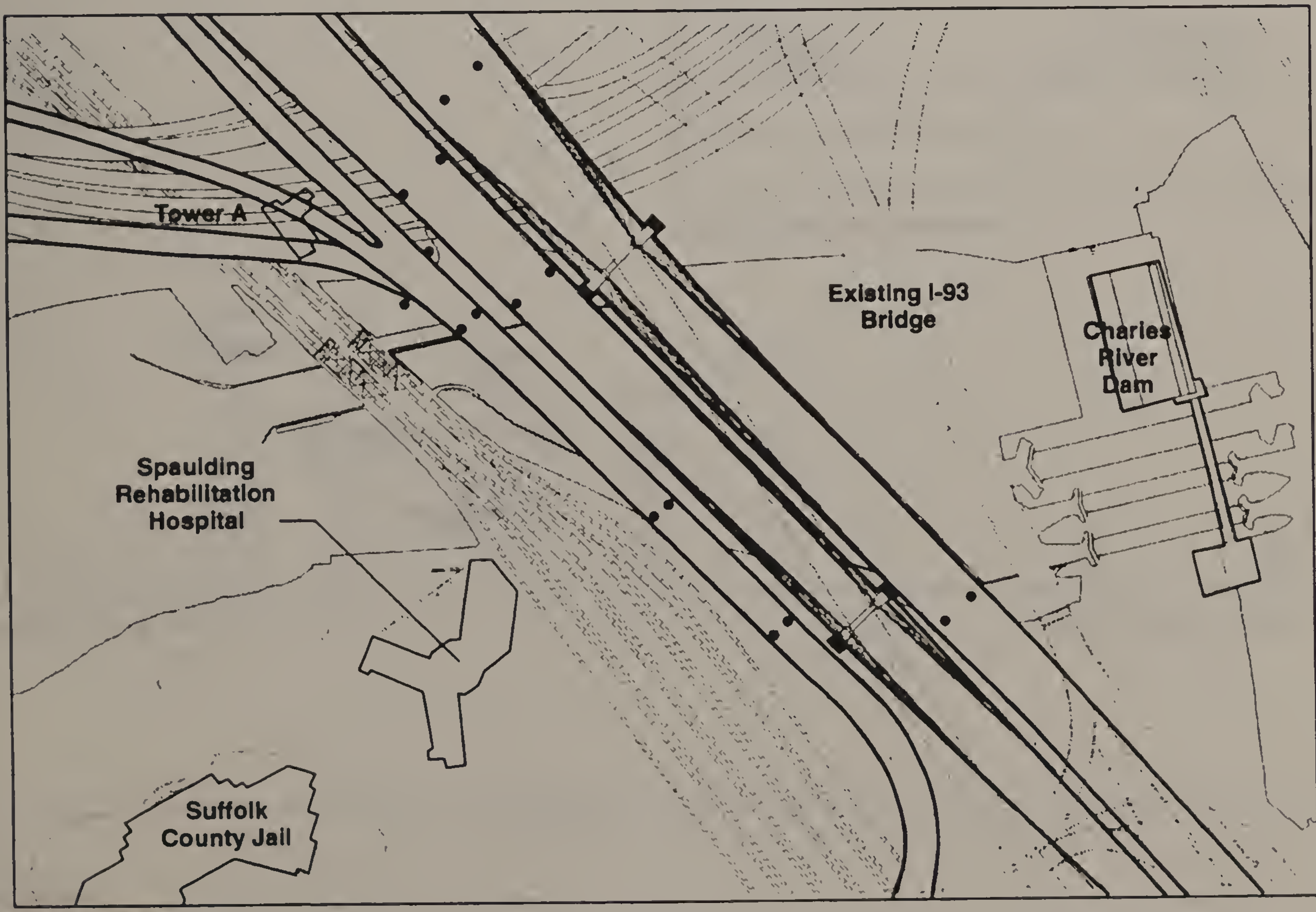
The Preferred Alternative also achieves consistency with the goals of the BDRC. The BDRC goals encompass the transportation goals of MHD and broaden environmental objectives to include aesthetic considerations.

- Reduce visual impacts of bridge and ramp height/massing to improve visual design: Scheme Z's visually disruptive impact of three bridges with inconsistent profiles has been eliminated. The Preferred Alternative does not include any double-deck structures; its two bridges have visually consistent profiles. The number of loop ramps has been reduced from six loop ramps of varying elevations to three loop ramps which merge to two and maintain similar elevations along the Charles River. The maximum height of loop ramp structures has been reduced from 105 feet to 35 feet adjacent to the north bank of the Charles River. The loop ramps maintain a minimum 120-foot setback from the north bank of the Charles River. The number of lanes crossing the Charles River has been reduced from sixteen to fourteen while adding the additional traffic from the new downtown on-ramp. The diamond-shaped towers at either end of the mainline bridge contribute to the visual effect of the impressive structure. It is possible that the bridge-type study may indicate that a modified tower design is needed due to engineering difficulties. However, these modifications could be incorporated without substantially altering the visual appearance of the cable-stayed structure. All of these design developments represent a substantial improvement over Scheme Z (see Figures 2.13 through 2.15).

- Restore the Traverse Street on-ramp or an equivalent move to reduce additional traffic on local streets and reduce adverse noise and air quality impacts: The Preferred Alternative provides a new downtown on-ramp at New Sudbury Street which provides for access to I-93 northbound from the downtown central business district (i.e., an equivalent move to the Traverse Street on-ramp). This access was not provided in Scheme Z.
- Provide for positive development/design of parkland along the Charles River Basin, which is adversely affected by Scheme Z: The Preferred Alternative allows more open space for parkland development than is possible with Scheme Z. The Preferred Alternative encourages parkland development by moving loop ramp structures away from the north bank of the Charles River. In Scheme Z, a 105-foot-high loop ramp structure was located adjacent to the north bank of the Charles River. The 35-foot-high loop ramps of the Preferred Alternative maintain a minimum 120-foot setback from the north bank, providing enhanced opportunities for parkland development. This facilitates the development of New Charles River Basin parklands through the mitigation program described in Chapter 6. MHD and the MDC will jointly provide that the area of the basin affected by the Preferred Alternative is developed to the greatest extent possible in a manner consistent with the MDC's master plan for this area.
- Investigate alternative schemes, including partial and/or full tunnel alternatives, to find a superior solution to the river crossing: The Project and the BDRC investigated 12 families of improvement packages and numerous variations within these families in furtherance of this goal. The Preferred Alternative represents a partial tunnel solution to the river crossing. Two land-based tunnels beneath the North Station area provide connections between I-93 south of the Charles River and Storrow Drive. The inclusion of these tunnels allows for the elimination of the "double crossing" of the Charles River required by Scheme Z.
- Reduce negative impact of bridge piers and overhead structures on aquatic resources and navigation in the Charles and Millers Rivers and on open space along their banks: The Preferred Alternative reduces negative impacts on aquatic resources and navigation in the Charles River by incorporating a long-span bridge design which facilitates navigation by minimizing the number of bridge piers in the river. The Preferred Alternative also avoids potential construction period impacts on aquatic resources which may result from tunneling in the Charles River. While the Preferred Alternative, and all of the other alternatives studied in the DSEIS/R, require filling a portion of the Millers River, this area was, in any event, completely covered by overhead structures under Scheme Z. Filling the Millers River, a body of water whose flow is dependent upon underground culverts designed to direct stormwater runoff, aids in the effort to remove loop ramp structure back from the banks of the Charles River. This provides superior open space opportunities for the Charles River north bank when compared to Scheme Z, without sacrificing any valuable wetlands functions.
- Incorporate/improve non-automobile transportation, including pedestrian and bicycle routes, ferry service at Lovejoy Wharf, and bus and HOV routes: The mitigation program developed in conjunction with the Preferred Alternative provides for complete pedestrian and bicycle circulation in the New Charles River Basin and it does so by opening up additional area on the north bank of the Charles River. Ferry service will be provided at Lovejoy Wharf in accordance with the provisions of the Projectwide consolidated license issued under Chapter 91 by the DEP. Unlike Scheme Z, the Preferred Alternative design incorporates a southbound HOV lane on I-


Tower A
Existing I-93 Bridge
Charles River Dam
Suffolk County Jail

Preferred Alternative


Tower A
Existing I-93 Bridge
Charles River Dam
Spaulding Rehabilitation Hospital
Suffolk County Jail

Scheme Z

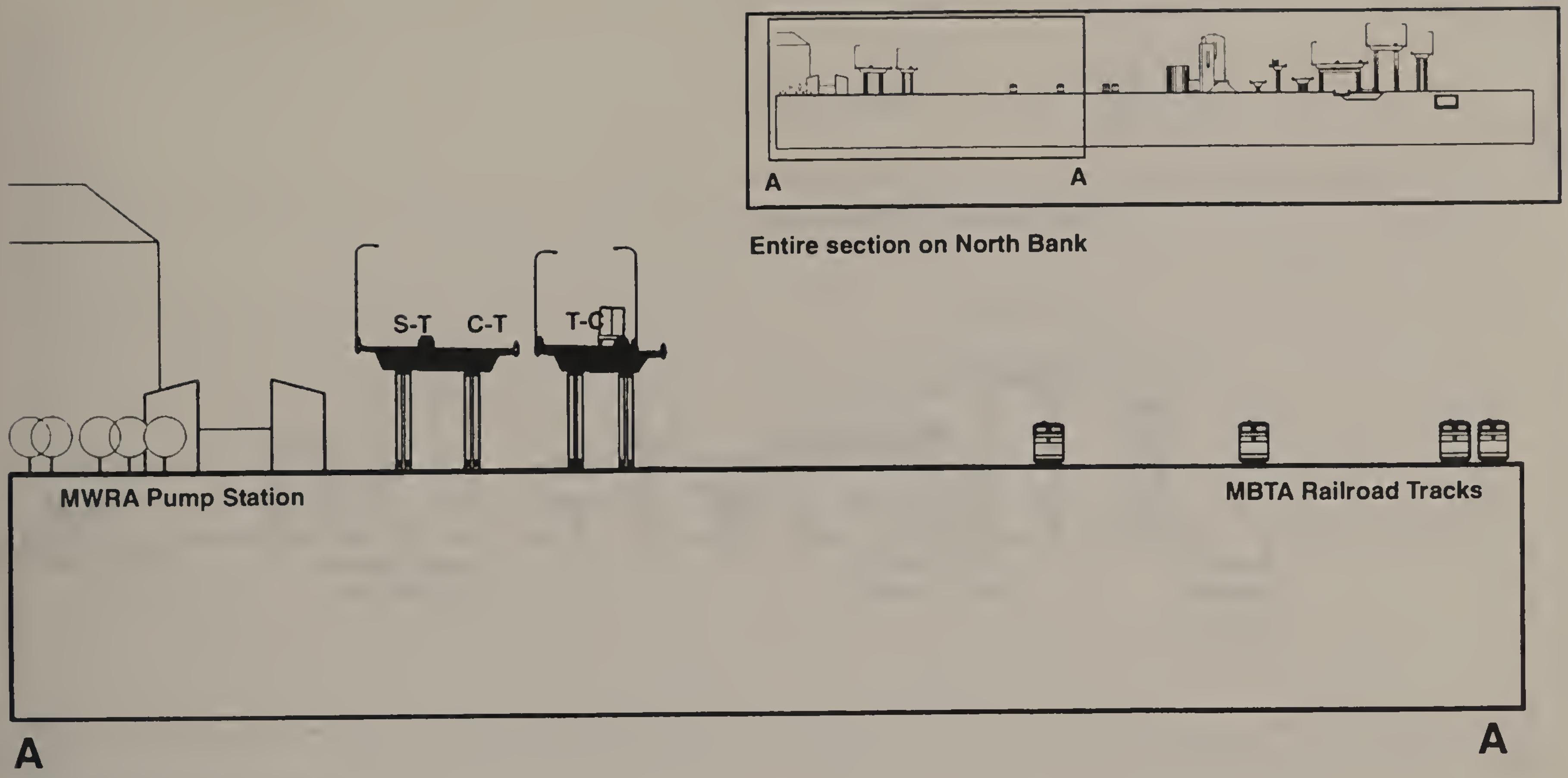
FIGURE 2.13

Plan Views Of Charles River Bridges: Preferred Alternative And Scheme Z

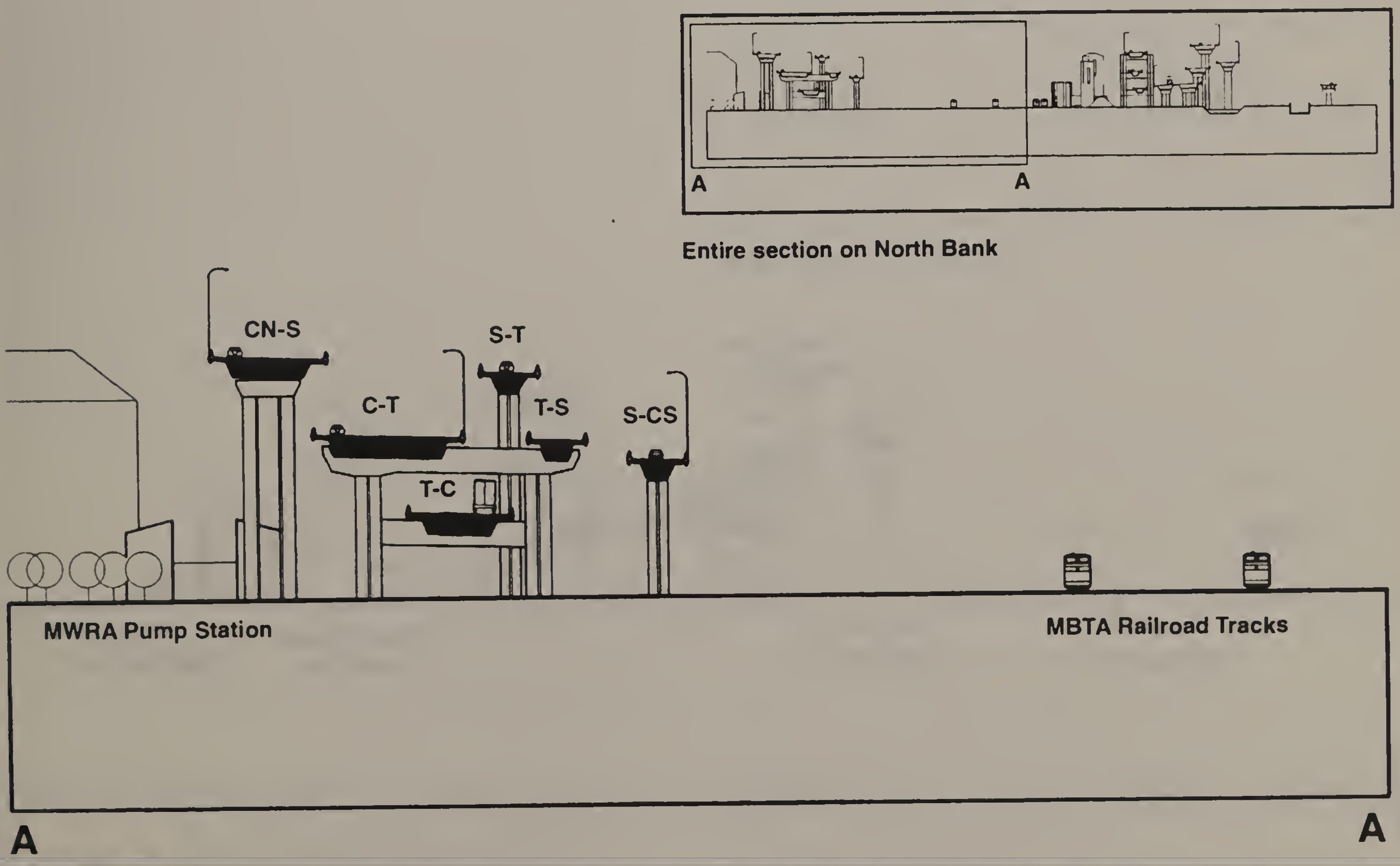
Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 100 200 400 FEET


A
A
Entire section on North Bank
S-T
C-T
T-C
MWRA Pump Station
MBTA Railroad Tracks
A
A

Preferred Alternative


A
A
Entire section on North Bank
CN-S
S-T
C-T
T-S
S-CS
T-C
MWRA Pump Station
MBTA Railroad Tracks
A
A

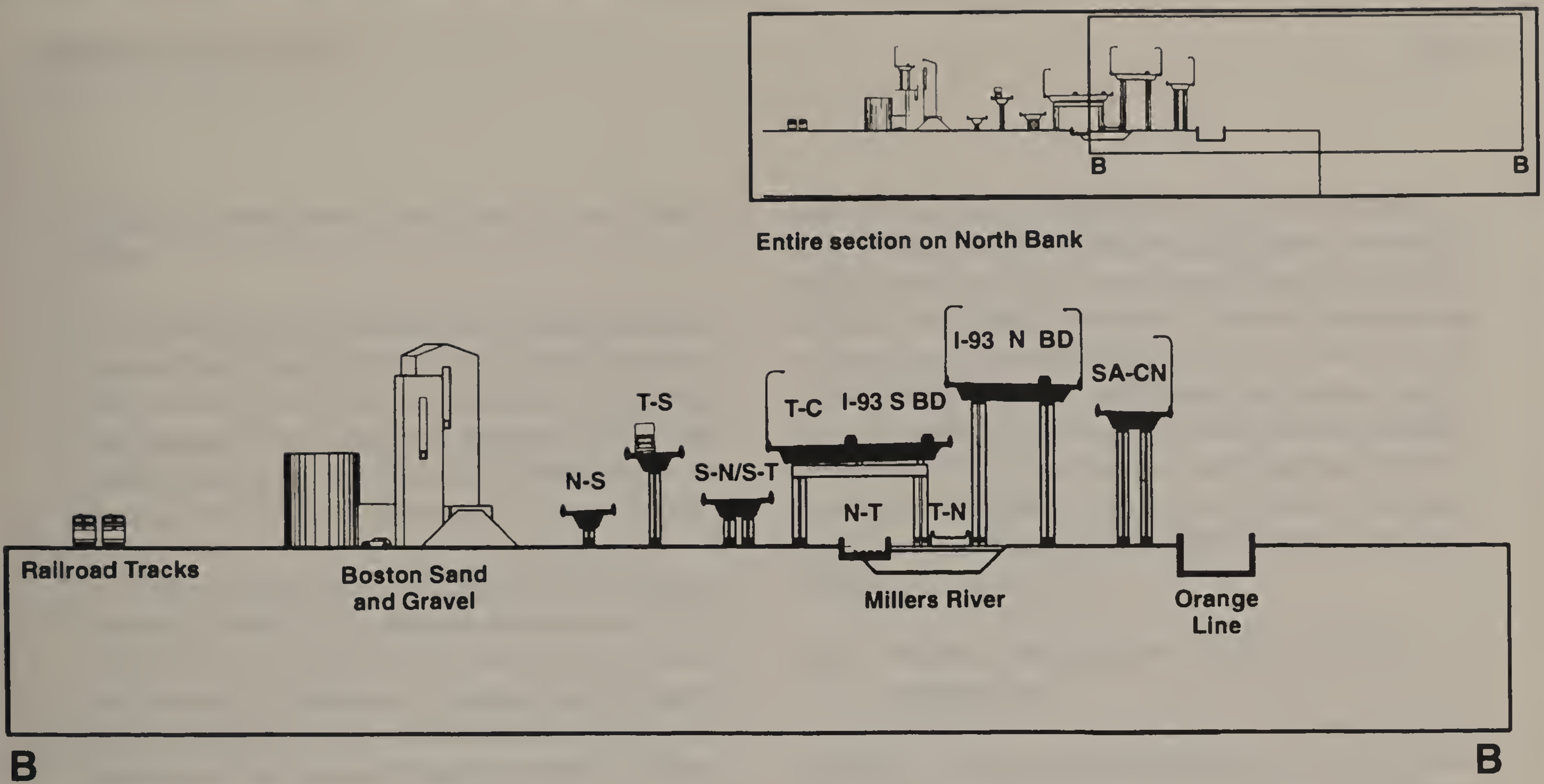
Scheme Z

FIGURE
2.14

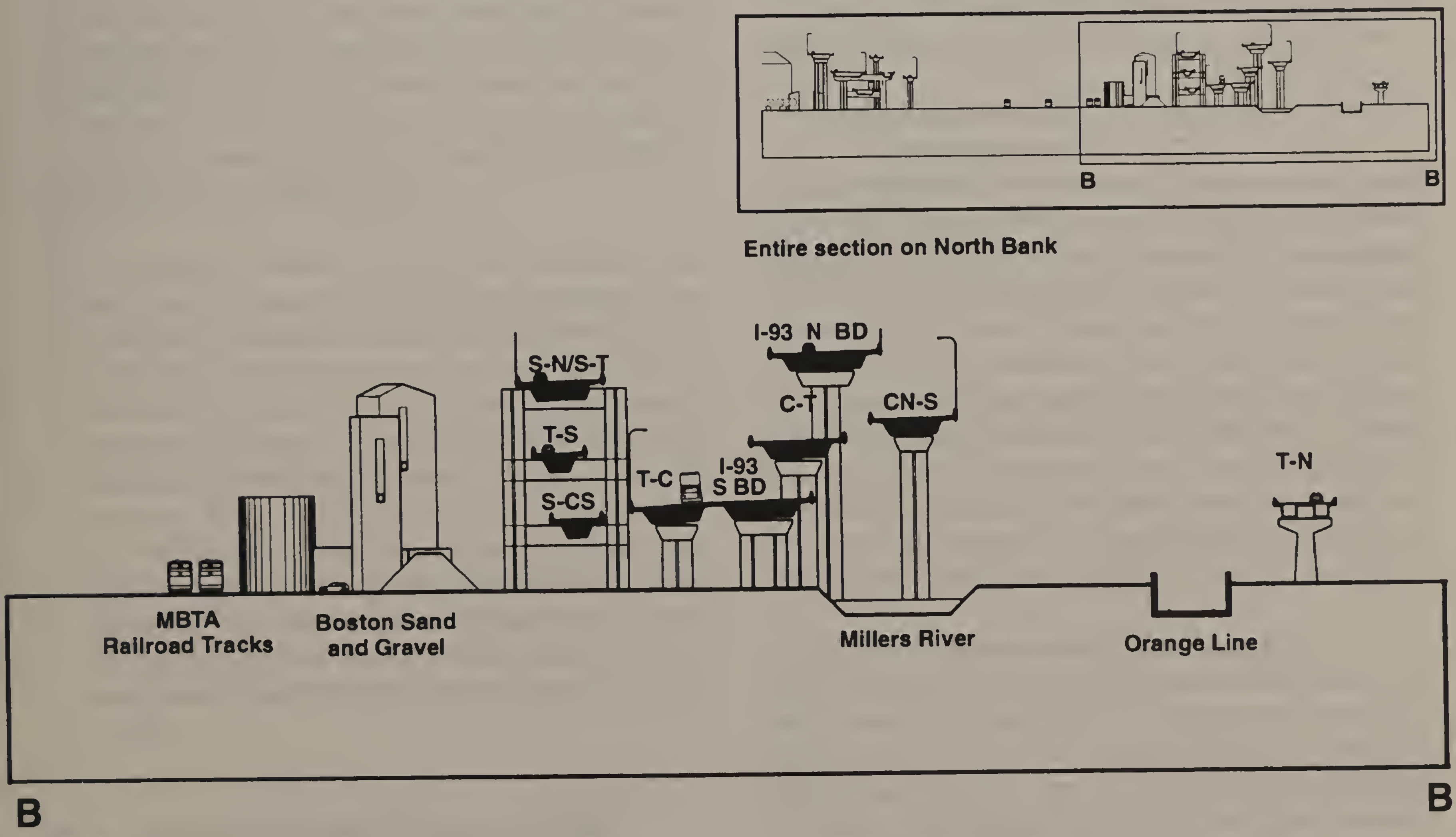
Sections At Loop Ramps On North Bank: Preferred Alternative And Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


B
B
Entire section on North Bank
I-93 N BD
SA-CN
T-S
T-C
I-93 S BD
N-S
S-N/S-T
N-T
T-N
Railroad Tracks
Boston Sand and Gravel
Millers River
Orange Line
B
B

Preferred Alternative


B
B
Entire section on North Bank
I-93 N BD
S-N/S-T
C-T
CN-S
T-S
T-C
I-93 S BD
S-CS
T-N
MBTA Railroad Tracks
Boston Sand and Gravel
Millers River
Orange Line
B
B

Scheme Z

FIGURE 2.15

Sections At Loop Ramps On North Bank: Preferred Alternative And Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

93 to the approximate north bank of the Charles River.

- Provide pedestrian and bicycle routes along both banks of the Charles River and connections both to and across the river from Charlestown, Cambridge, and Boston: The mitigation program for the Preferred Alternative provides the mechanism for allowing the MDC to implement these connections.

- Maintain/review all connections to the regional roadway system: Give special consideration to the role played by Storrow Drive in the regional system and maintain its character as part of the Esplanade. The Preferred Alternative maintains the essential connections of the regional roadway system including the connection providing the link between Storrow Drive and I-93/Route 1 northbound. While the Preferred Alternative provides for an underpass at Leverett Circle, construction of this underpass does not involve any infringement upon the Esplanade and this eastbound underpass is in fact further removed from the Esplanade than the existing westbound underpass. The Preferred Alternative does not adversely affect the character of Storrow Drive or the Esplanade itself.

- Minimize construction impacts; maintain road and transit connections during construction: The Preferred Alternative minimizes construction impacts (including impacts to road and transit connections) by having a construction duration consistent with Scheme Z. Thus, the considerable benefits derived from the Preferred Alternative can be obtained within virtually the same construction period as Scheme Z. Designs incorporating river tunnels produce additional construction impacts such as interference with navigation; disturbance of river sediment; disposal/trucking of additional excavated and dredged materials; and longer construction time frames.

2.4 DESCRIPTION OF ALTERNATIVES AND REFINEMENTS NOT SELECTED

The following section describes the proposed refinements to the Preferred Alternative and the other designs that were considered, but not selected as the Preferred Alternative for the Charles River Crossing. The descriptions in this section highlight the key features and impacts of these designs, including differences among the designs and the factors which contributed to the selection of the Preferred Alternative. Detailed evaluation of the impacts of the other design alternatives can be found in the 1993 DSEIS/R. Additional information on impacts of proposed refinements studied during preparation of this FSEIS/R is summarized in this section. The discussion corresponds with the description of the goals and objectives of the Charles River Crossing design as discussed in Section 2.2.

2.4.1 Further Refinements To The Preferred Alternative

A number of design refinements have been suggested for the Preferred Alternative. Five of these refinements were adopted and are described along with the Preferred Alternative in Section 2.1. Three additional refinements (identified in the 1993 DSEIS/R) were evaluated and rejected. The reasons for rejection of the suggested refinements that were not adopted are provided below.

2.4.1(a) Realignment Of Storrow Drive To North Traffic Movements

This refinement results in a single 12-lane mainline bridge across the Charles River and three viaduct loop ramps, merging to two ramps in East Cambridge. It represents a hybrid of the Reduced River-Tunnel Alternative and the Non-River-Tunnel Alternative as discussed in the 1993 DSEIS/R by combining the Reduced River-Tunnel Alternative bridge and the Non-River-Tunnel Alternative loop ramp structures. It was therefore proposed as a refinement to both alternatives. As it more closely relates to the Reduced River-Tunnel Alternative, the discussion of the impacts of this refinement and the reasons for its rejection are set forth in Section 2.4.4(c).

2.4.1(b) I-93 Northbound Right-Hand Exit

The purpose of this suggested design refinement is to reduce impacts to Paul Revere Landing Park South. It proposes a right-hand off-ramp from I-93 northbound to the Tobin Bridge. The I-93 northbound mainline is five lanes wide instead of the four-lane-plus-two-lane configuration (six lanes total). The two-lane ramp carrying traffic from downtown Boston and the Sumner Tunnel joins I-93 northbound as an additional fifth lane just north of Causeway Street. Traffic having a Tobin Bridge (Route 1 northbound) destination exits right from the mainline and crosses over both I-93 northbound and

I-93 southbound. This results in a wider cross section since the mainlines need to have the same profile, and thus cannot begin to stack, until the right-hand exit clears the proposed I-93 southbound structure. The existing I-93 structure must remain in service until the new facilities are constructed; therefore, a wider proposed mainline moves the Storrow Drive connections and the viaduct loop ramps approximately 150 feet farther northwest into East Cambridge and into the MBTA commuter railroad yard.

Although this refinement attempted to reduce the impact of the mainline bridge on Paul Revere Landing Park South, this marginal benefit is not critical to the functional character of this park, and the benefit of this refinement was more than offset by corresponding negative impacts. First, the effort to reduce the number of northbound lanes on the mainline bridge, like other efforts to achieve this goal, has serious negative consequences on traffic operations on both the mainline highway system and the local street network. In addition, as stated above, a right-hand exit would cause the loop ramp structures in East Cambridge to push toward the northwest. In addition to increasing proximity impacts on parkland in the North Point area, this would cause physical conflicts with MBTA commuter railroad yard operations, the BSG facility, the MWRA chlorination pumping station, and the proposed development in North Point.

2.4.1(c) Ramp C-T In Tunnel

This suggested refinement of Ramp C-T in tunnel, although geometrically feasible, requires approximately a 6.5 percent downgrade in order for the roadway to clear the MBTA commuter railroad tracks at the ramp's northern limit before entering into a tunnel to pass under the railroad tracks at the ramp's southern limit. Once under the tracks, the tunnel must then rise again to meet the existing approach grade to the CANA tunnel.

The resultant geometry is that the profile of Ramp C-T has a "roller coaster" effect. Shortly after exiting the mainline the ramp descends on a 6.5 percent downgrade, rises again on a 5 percent upgrade to the surface before meeting the existing 5 percent CANA downgrade. The only segment of Ramp C-T that remains in tunnel is the short section beneath the MBTA commuter railroad tracks. In addition, the refinement results in adverse impacts to land uses in the North Point area and to pedestrian access due to the presence of an open transition section. For these reasons, this refinement was rejected.

2.4.1(d) Refinements To New Eastbound Underpass At Leverett Circle

The purpose for studying a single two-way underpass at Leverett Circle was an attempt to maintain the existing location of the proposed westerly portal, which would minimize construction impacts on Storrow Drive.

The width needed to construct a new four-lane tunnel that complies with Project Design Criteria and is structurally sound is approximately 93 feet. This distance does not include sight shelf requirements, which vary depending upon the horizontal curvature. In any event, to maintain this width for the tunnel without encroaching onto the Esplanade, the new tunnel portal must be located approximately 50 feet west of the originally proposed eastbound tunnel portal. To maintain the westerly portal location requires approximately a 13-foot encroachment into the Esplanade which is unacceptable. Consequently, using this approach increases construction impacts on Storrow Drive west of the existing tunnel portal location.

In addition, using "parkway" design standards (similar to other MDC roadways), the minimum tunnel width necessary is approximately 78 feet. This approach uses a similar geometric configuration as above, but with reduced lane widths and minimal tunnel sidewalk and shoulder widths. To maintain this width for the tunnel without encroaching onto the Esplanade, the new tunnel portal must be located at approximately the original location of the proposed eastbound tunnel portal.

All of the above approaches to this refinement require total reconstruction of the existing underpass and, subsequently, a diversion of traffic through the signal at Leverett Circle for about 2 years during construction. As a result, and since construction impacts along Storrow Drive do not decrease, this refinement was rejected. Despite the rejection of this refinement, MHD recognizes the desire to maintain the character of Storrow Drive, and will develop the design of the underpass, surface roads, and appurtenances to be consistent, to the fullest extent possible, with the existing character of the parkway.

2.4.2 Scheme Z

Scheme Z is the Proposed Action of the 1991 FSEIS/R. With the broadening of the Project's goals and objectives to include those of the BDRC, Scheme Z no longer completely satisfies Project goals and objectives, particularly when compared to the Preferred Alternative. The following section describes Scheme Z and refinements to Scheme Z that were evaluated, and identifies reasons for its rejection. (See Figure 2.16 for structures and Figures 2.17 through 2.20 for main travel routes.)

2.4.2(a) Description

Scheme Z features two long-span bridges, with towers on both sides of the Charles River, each comprised of five lanes in one direction. In addition, a six-lane (three over three) double-deck structure that differs in type and profile from the mainline bridges is required to accommodate traffic movements to and from Leverett Circle/Storrow Drive. This provides a total of 16 lanes and three bridge structures over the Charles River. Since there are no tunnels in Scheme Z, ventilation buildings are not required.

The roadway links provided in Scheme Z are described in Section 2.2.2 of the 1993 DSEIS/R.

2.4.2(b) Reasons For Rejection

Traffic Operations and Safety.
Overall, Scheme Z's level of improvement to the efficiency of traffic operations and safety is not as high as the level of improvement resulting from the Preferred Alternative as summarized below:

- Scheme Z does not provide access to I-93 northbound from the northern downtown area. This omission results in an increase in traffic volumes on local streets and a less efficient use of the regional highway system.

- Scheme Z lacks an exclusive HOV lane on I-93 southbound.

- Scheme Z's design requires a double crossing of the Charles River thereby lengthening the distance travelled and increasing both the VMT and vehicle hours of travel (VHT) for this alternative. VMT and VHT are approximately 2 percent higher than with the Preferred Alternative.

- The local Charlestown off-ramp is located in City Square, and the resulting traffic volumes cause City Square traffic operations to fail.

Environmental And Aesthetic Impacts. Overall, the structures of Scheme Z have adverse impacts both environmentally and aesthetically as summarized below:

- Scheme Z's bridges, with 11 piers in the Charles River, have a high impact on aquatic and open space resources (the Preferred Alternative has just 4 piers in the Charles River).

- Scheme Z has slightly diminished direct impacts to the Millers River when compared to the Preferred Alternative; however, Scheme Z covers the Millers River with overhead structure.

- Scheme Z's large mass of structure on the north bank of the Charles River reduces the potential of the MDC Master Plan to improve the extended recreational parkland area along the Charles River. These structures also create proximity impacts to the parkland in the new Charles River Basin.

- Scheme Z also adversely affects a planned private housing development at the North Point section of Cambridge. The Preferred Alternative reduces these impacts substantially.

- Scheme Z's areawide emission levels of air pollutants exceed those of the Preferred Alternative due to the increased VMT generated by the double river crossing.

2.4.2(c) Conclusion

The Preferred Alternative has demonstrably fewer adverse environmental and aesthetic impacts than Scheme Z, and results in better traffic operations. For these reasons, Scheme Z was not identified as the Preferred Alternative.

2.4.3 Alternative 8.1D Mod 5

Alternative 8.1D Mod 5 is described on the basis of the design shown in the 1992 NPC, with additional discussion of subsequent design refinements as documented in the 1993 DSEIS/R. The main feature of this design is that over 10,000 linear feet (lf) of structure are in tunnel, the greatest length of tunnel structure of any of the alternatives. Alternative 8.1D Mod 5 includes a 10-lane mainline bridge and a single loop ramp in East Cambridge (see Figures 2.21 for structures and 2.22 through 2.25 for main travel routes).

2.4.3(a) Description

As described in the NPC, the bridge includes a cable-stayed structure with a single twin-legged tower along the north side of the Charles River. In addition, a ventilation building located south of the Charles River is required to service the three-lane northbound tunnel under the river and the land-based tunnels under East Cambridge, the North Station commuter railroad tracks, the Spaulding Rehabilitation Hospital, and Nashua Street. The size of this ventilation building and the location of the three-lane northbound tunnel under the Charles River require this building to be built above grade. Exhaust stacks and fresh air intake stacks extend from the roof of the ventilation building.

The I-93 mainline highway crosses over the Charles River on a single bridge consisting of four lanes each in northbound and southbound directions. An additional two lanes on the western side of the mainline bridge carry I-93/Route 1 southbound traffic to Leverett Circle/Storrow Drive, for a total of 10 lanes over the river. Descriptions of the roadway links are provided in Section 2.3.2 of the 1993 DSEIS/R.

2.4.3(b) Reasons For Rejection

Although Alternative 8.1D Mod 5 satisfies many of the objectives listed in Section 2.2, it does not provide the level of overall improvement achieved by the Preferred Alternative. Key considerations that led to the rejection of Alternative 8.1D Mod 5 include:

Traffic Operations And Safety. Alternative 8.1D Mod 5's level of improvement to traffic operations and safety is not as high as the Preferred Alternative's because of the following:

- Degradation of highway safety due to the length, grades, and configuration of highway tunnels
- Impedance of traffic flow and access to the regional highway system due to severe congestion at Leverett Circle

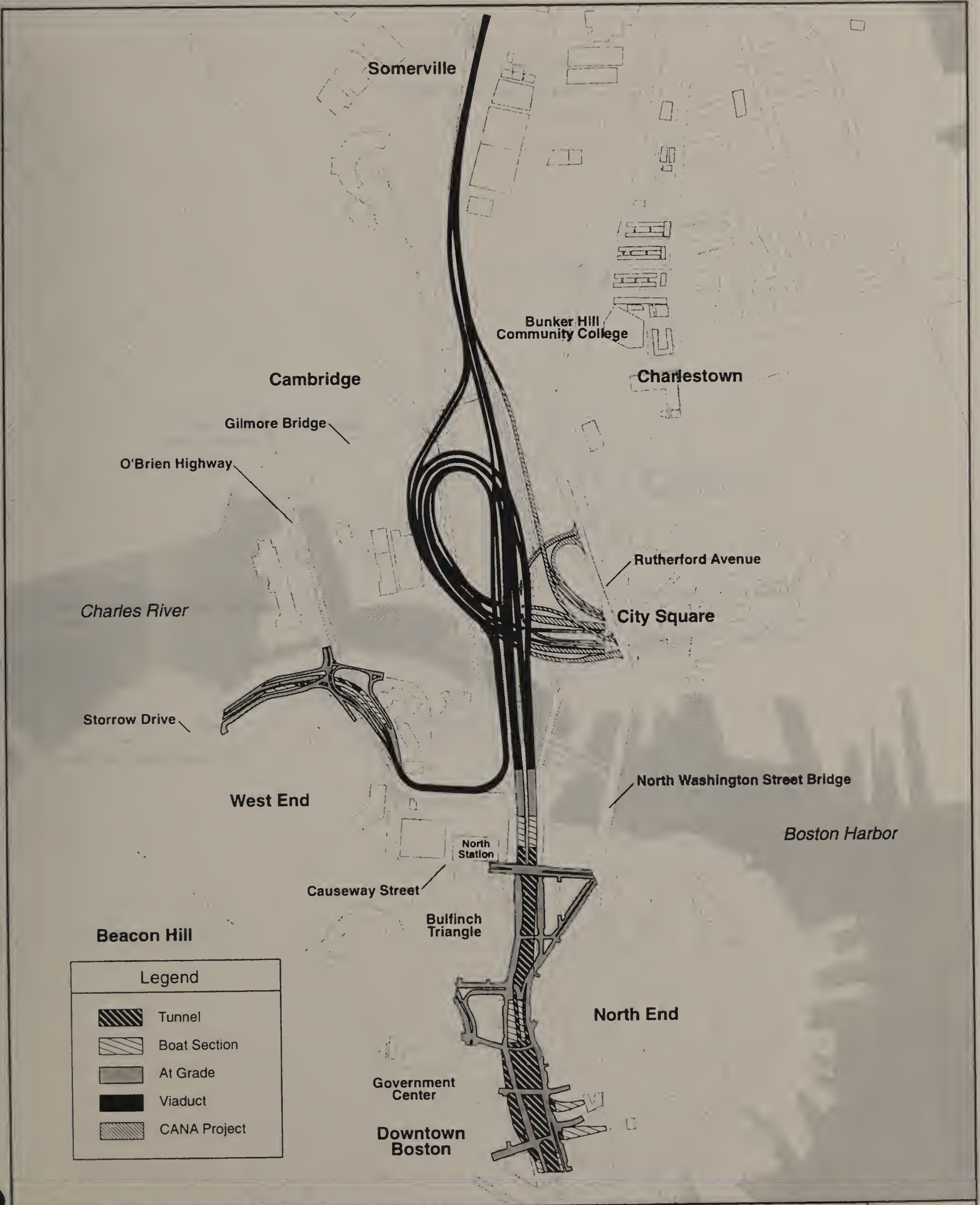
The following describes these features in detail:

Highway Safety: The dominant distinguishing feature of Alternative 8.1D Mod 5 is that more than 10,000 lf of the highway system are in tunnel, including a series of regional and local traffic connections. The two major traffic movements that are accommodated in tunnel in Alternative 8.1D Mod 5 and on above-ground viaducts in the Preferred Alternative are Central Artery (I-93) northbound to Tobin Bridge (Route 1) northbound (C-T) and the Storrow Drive eastbound and Leverett Circle local to I-93 northbound and Tobin Bridge (Route 1) northbound (S-N/L-N).

The first major traffic movement accommodated in tunnel in Alternative 8.1D Mod 5 is the C-T connection, the highest traffic volume connection in the I-93/Route 1 interchange. The C-T connection follows a circuitous alignment, beginning with an underground exit from the mainline tunnel in Haymarket area. Traffic must then proceed more than one mile through a series of horizontal and vertical curves in tunnel combined with two major destination decision points, each with multiple destinations, and two major on-ramp merges prior to emerging from tunnel at the Tobin Bridge approach. This connection presents a higher potential for driver confusion and accidents.

By contrast, in the Preferred Alternative, motorists desiring to make connection between the Central Artery and the Tobin Bridge continue straight in the mainline tunnel with all northbound traffic. Once traffic emerges from the tunnel and crosses the Charles River on the new bridge, a single decision point is encountered. Motorists must simply decide whether to continue on I-93 northbound or exit to the Tobin Bridge (Route 1 northbound). Within this section of highway there are no merge conditions to add to motorist confusion and potential accident rates are reduced.

The second major traffic movement accommodated in tunnel in Alternative 8.1D Mod 5 and on viaduct in the Preferred Alternative is the Storrow Drive eastbound and Leverett Circle local connection to both I-93 northbound and the Tobin Bridge (Route 1 northbound) (S-N/L-N). In Alternative 8.1D Mod 5 all traffic making this connection is forced to enter a steep downgrade tunnel approach from a signalized intersection at Leverett Circle. Once in the tunnel, motorists must decide between connecting with the Central Artery (I-93 southbound) or points north, either I-93 northbound or the Tobin Bridge (Route 1 northbound). Traffic continuing


Somerville
Bunker Hill Community College
Cambridge
Charlestown
Gilmore Bridge
O'Brien Highway
Rutherford Avenue
Charles River
City Square
Storrow Drive
North Washington Street Bridge
West End
Boston Harbor
North Station
Causeway Street
Bulfinch Triangle
Beacon Hill
North End
Government Center
Downtown Boston
Legend
Tunnel
Boat Section
At Grade
Viaduct
CANA Project

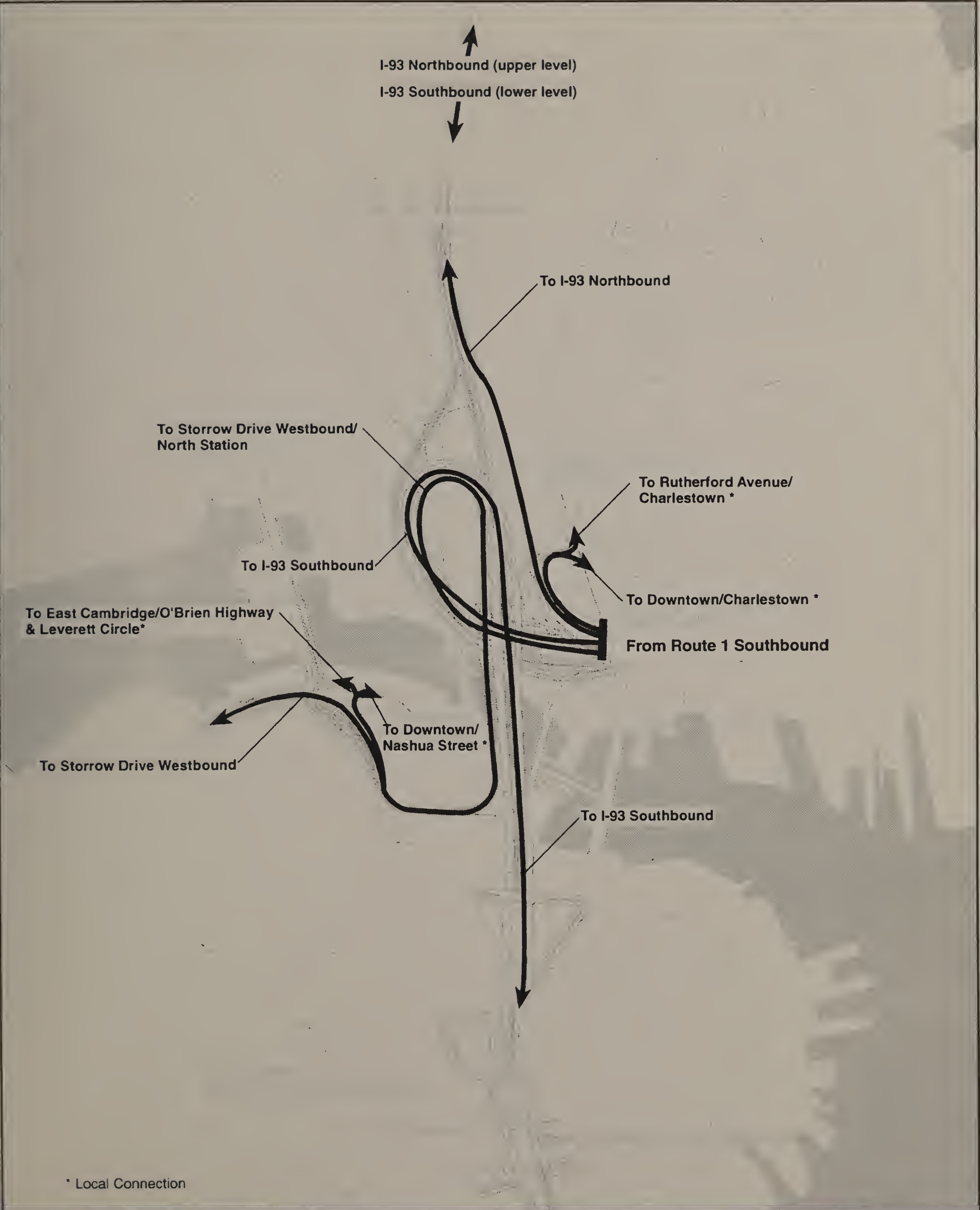
FIGURE

2.16 Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET



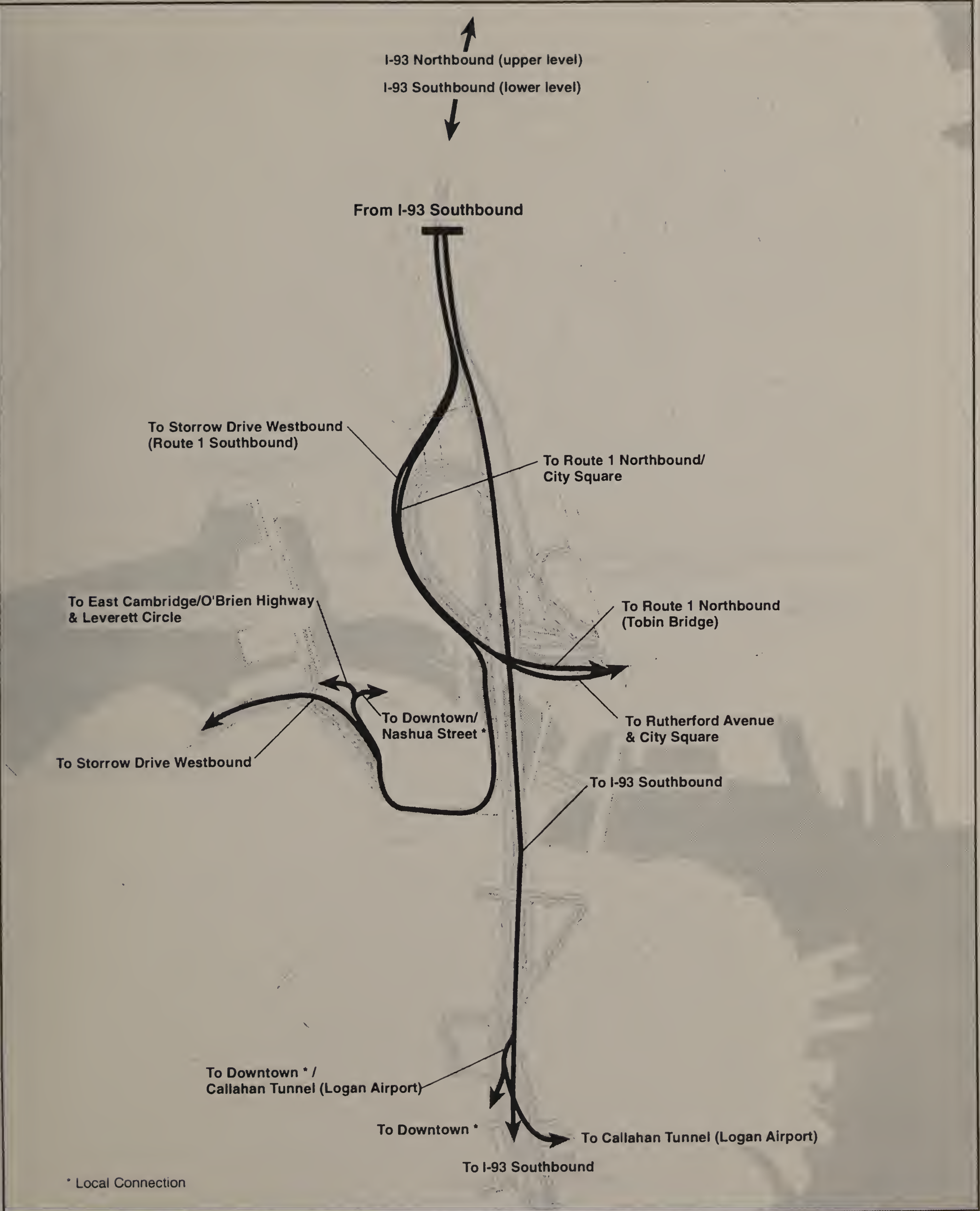
I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound
To Storrow Drive Westbound/ North Station
To Rutherford Avenue/ Charlestown *
To I-93 Southbound
To Downtown/Charlestown *
To East Cambridge/O'Brien Highway & Leverett Circle*
From Route 1 Southbound
To Downtown/ Nashua Street *
To Storrow Drive Westbound
To I-93 Southbound
* Local Connection

FIGURE 2.17 Travel Routes From Route 1 Southbound: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
From I-93 Southbound
To Storrow Drive Westbound (Route 1 Southbound)
To Route 1 Northbound/ City Square
To East Cambridge/O'Brien Highway & Leverett Circle
To Route 1 Northbound (Tobin Bridge)
To Downtown/ Nashua Street *
To Rutherford Avenue & City Square
To Storrow Drive Westbound
To I-93 Southbound
To Downtown * / Callahan Tunnel (Logan Airport)
To Downtown *
To Callahan Tunnel (Logan Airport)
To I-93 Southbound

* Local Connection

FIGURE

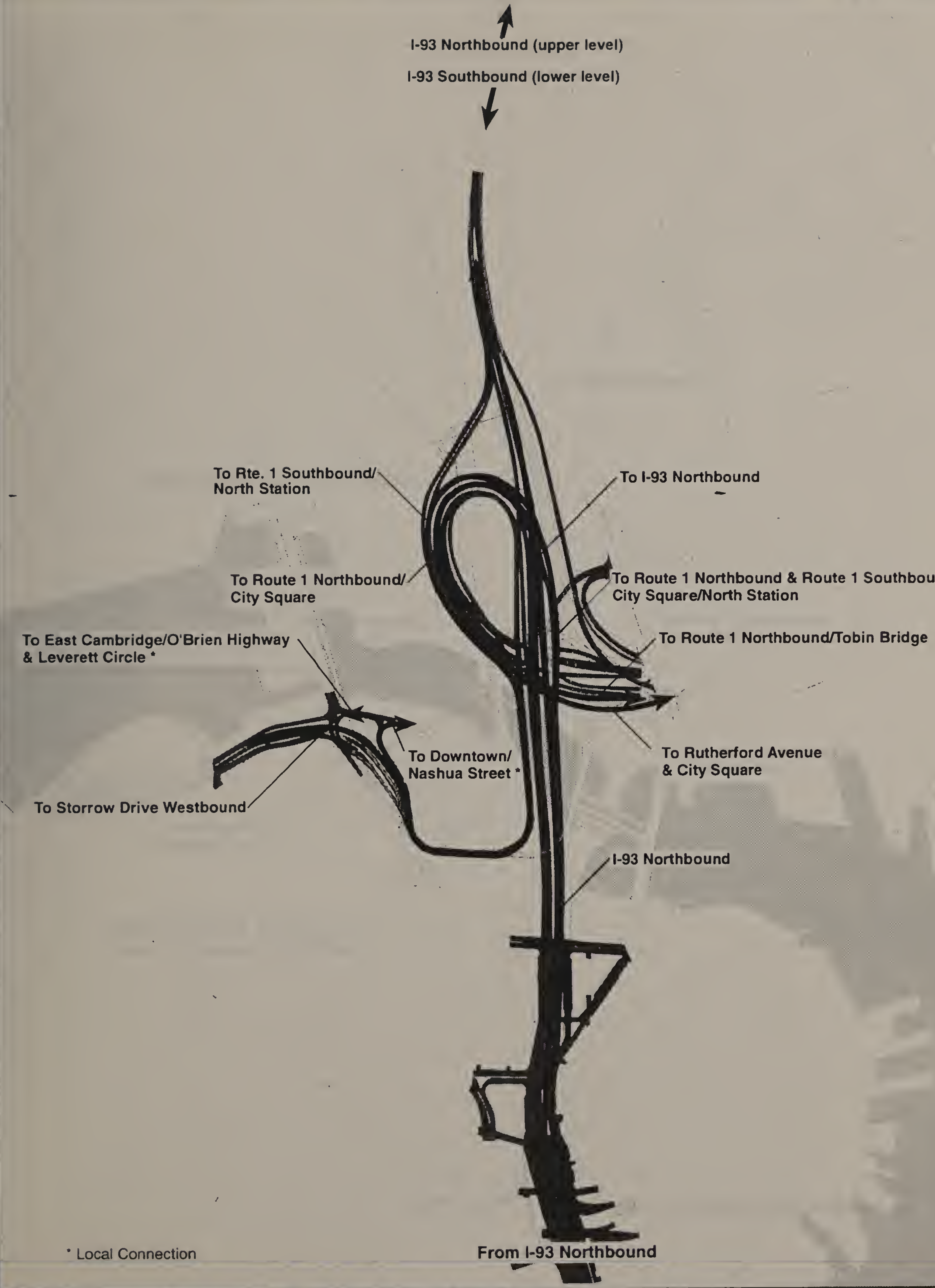
2.18

Travel Routes From I-93 Southbound: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET



I-93 Northbound (upper level)
I-93 Southbound (lower level)
To Rte. 1 Southbound/ North Station
To I-93 Northbound
To Route 1 Northbound/ City Square
To Route 1 Northbound & Route 1 Southbound/ City Square/North Station
To East Cambridge/O'Brien Highway & Leverett Circle *
To Route 1 Northbound/Tobin Bridge
To Downtown/ Nashua Street *
To Rutherford Avenue & City Square
To Storrow Drive Westbound
I-93 Northbound
From I-93 Northbound

* Local Connection

FIGURE

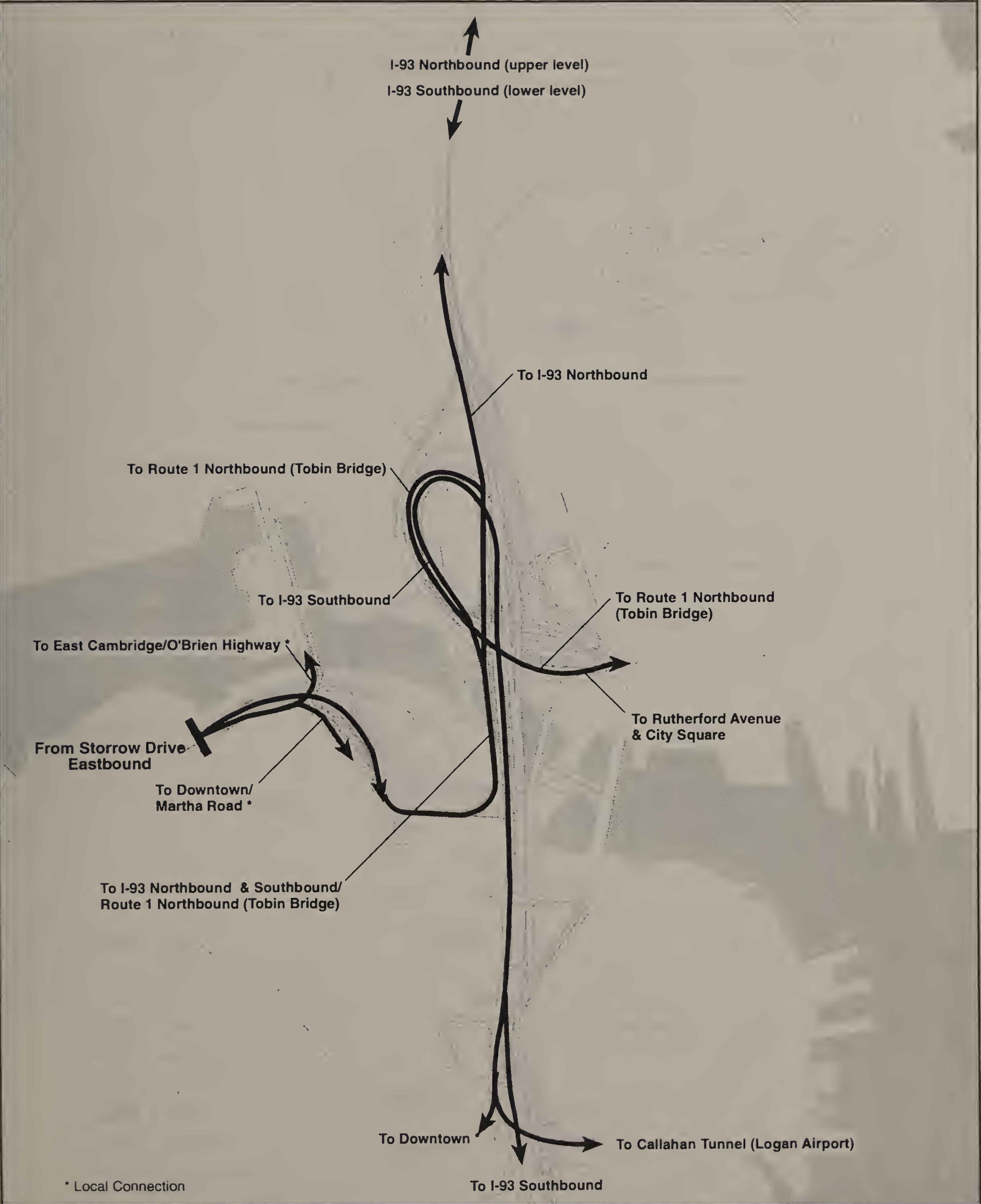
2.19

Travel Routes From I-93 Northbound: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound
To Route 1 Northbound (Tobin Bridge)
To I-93 Southbound
To Route 1 Northbound (Tobin Bridge)
To East Cambridge/O'Brien Highway *
To Rutherford Avenue & City Square
From Storrow Drive Eastbound
To Downtown/ Martha Road *
To I-93 Northbound & Southbound/ Route 1 Northbound (Tobin Bridge)
To Downtown
To Callahan Tunnel (Logan Airport)
To I-93 Southbound
* Local Connection

FIGURE

2.20

Travel Routes From Storrow Drive Eastbound: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET

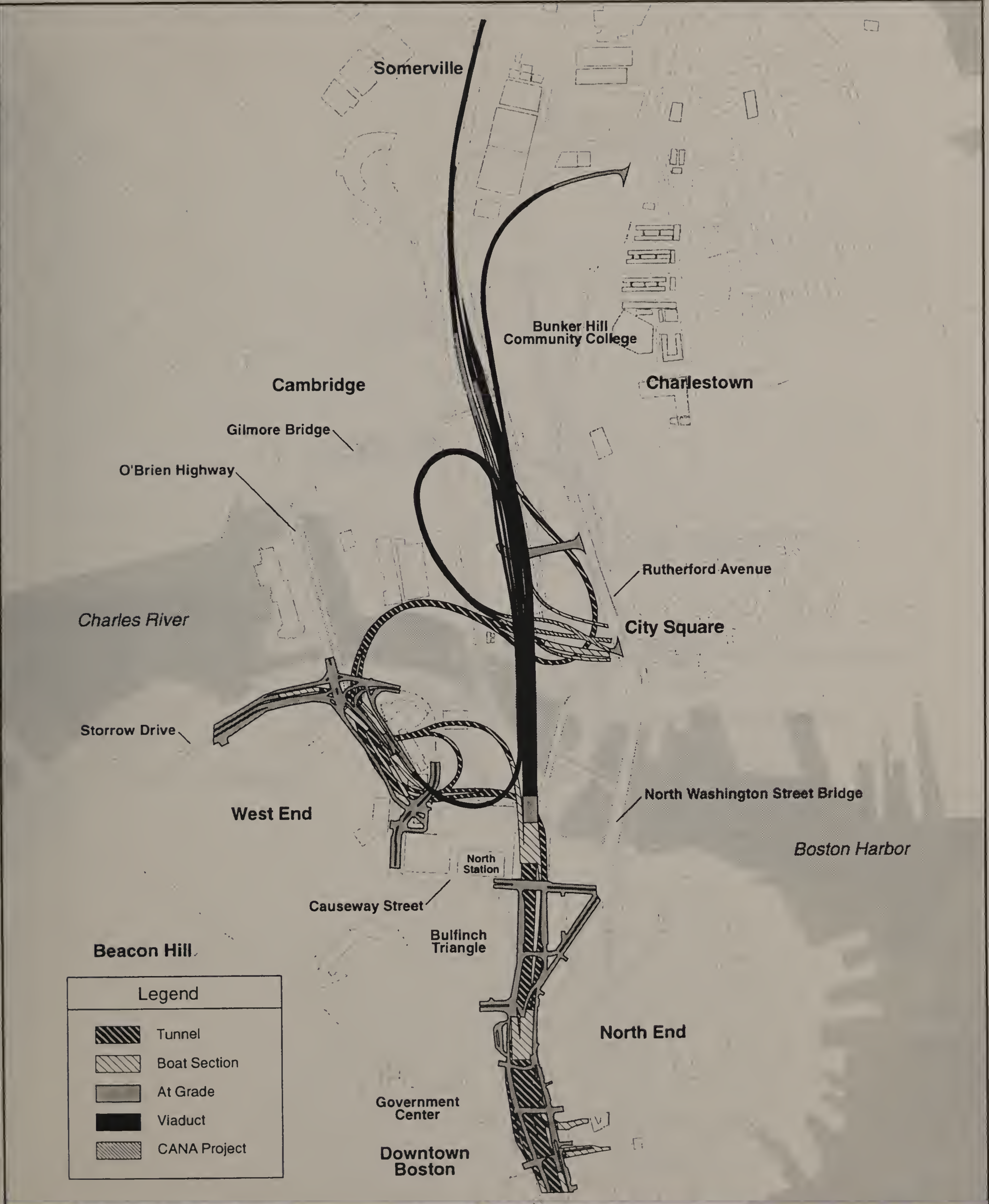
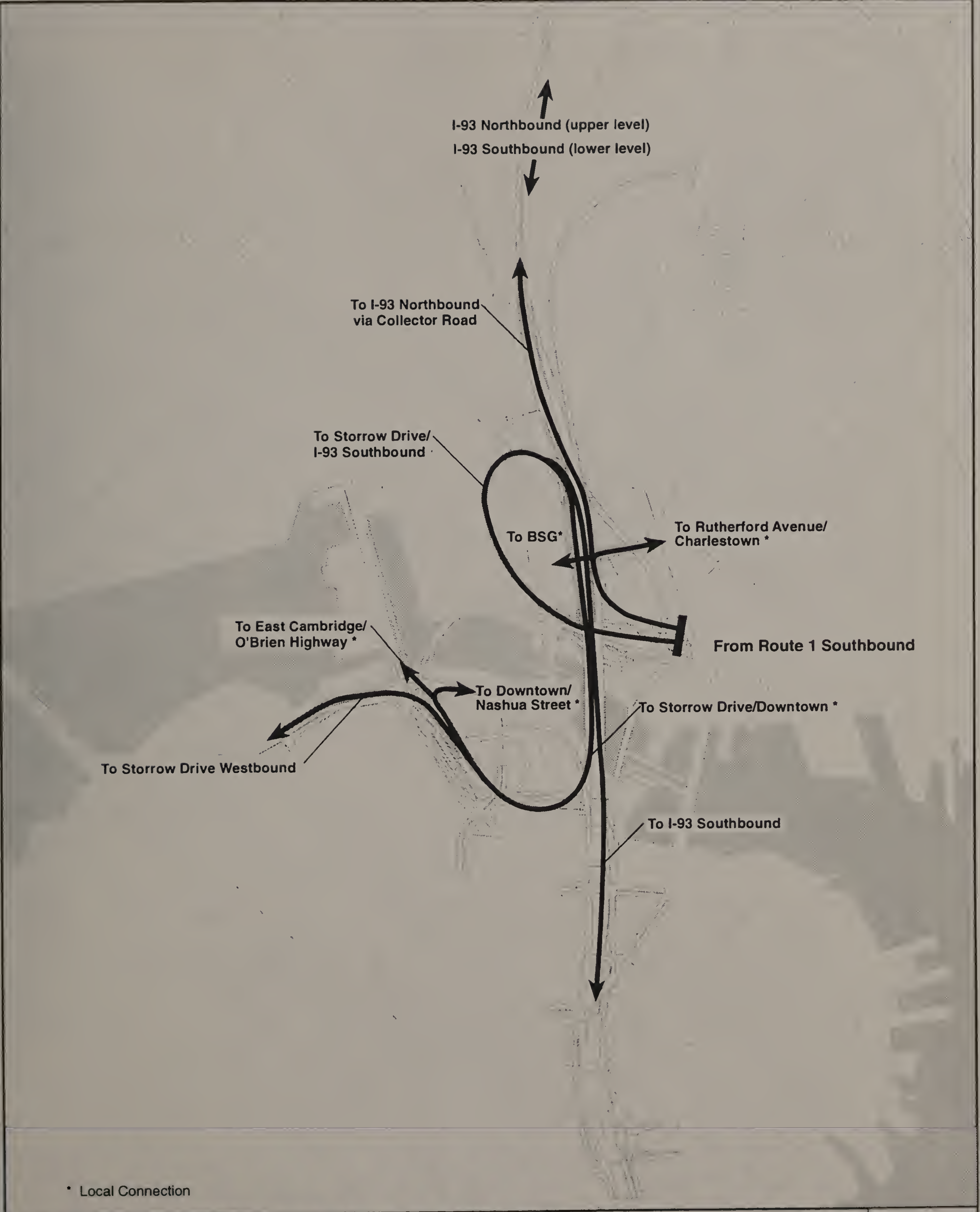

Somerville
Bunker Hill Community College
Cambridge
Charlestown
Gilmore Bridge
O'Brien Highway
Rutherford Avenue
City Square
Charles River
Storrow Drive
North Washington Street Bridge
West End
Boston Harbor
North Station
Causeway Street
Bulfinch Triangle
Beacon Hill
North End
Government Center
Downtown Boston
Legend
Tunnel
Boat Section
At Grade
Viaduct
CANA Project

FIGURE 2.21 Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound via Collector Road
To Storrow Drive/ I-93 Southbound
To BSG*
To Rutherford Avenue/ Charlestown *
From Route 1 Southbound
To East Cambridge/ O'Brien Highway *
To Downtown/ Nashua Street *
To Storrow Drive/Downtown *
To Storrow Drive Westbound
To I-93 Southbound

* Local Connection

FIGURE

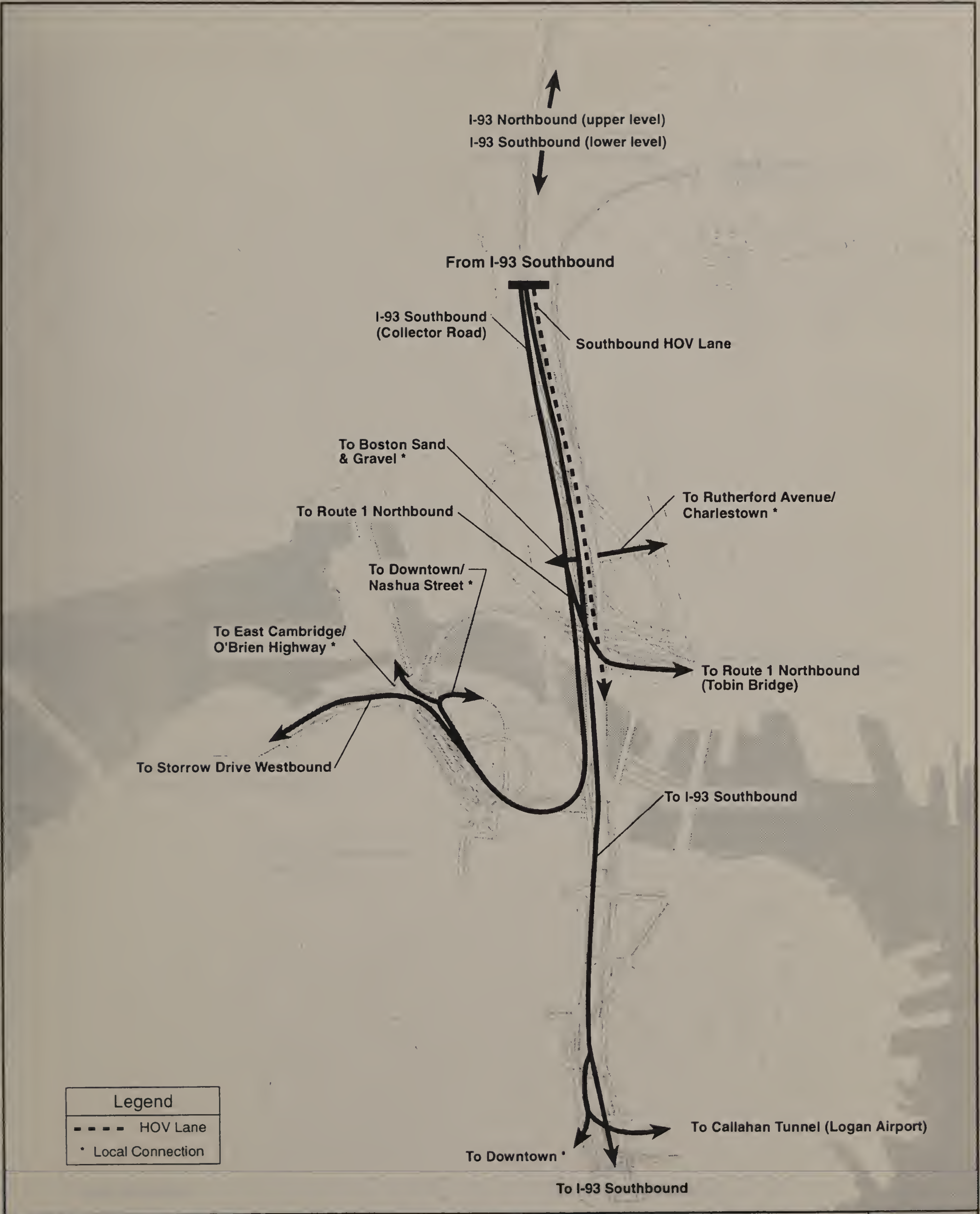
2.22

Travel Routes From Route 1 Southbound: Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
From I-93 Southbound
I-93 Southbound (Collector Road)
Southbound HOV Lane
To Boston Sand & Gravel *
To Route 1 Northbound
To Rutherford Avenue/ Charlestown *
To Downtown/ Nashua Street *
To East Cambridge/ O'Brien Highway *
To Route 1 Northbound (Tobin Bridge)
To Storrow Drive Westbound
To I-93 Southbound
Legend
HOV Lane
* Local Connection
To Callahan Tunnel (Logan Airport)
To Downtown *
To I-93 Southbound

FIGURE

2.23

Travel Routes From I-93 Southbound: Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET

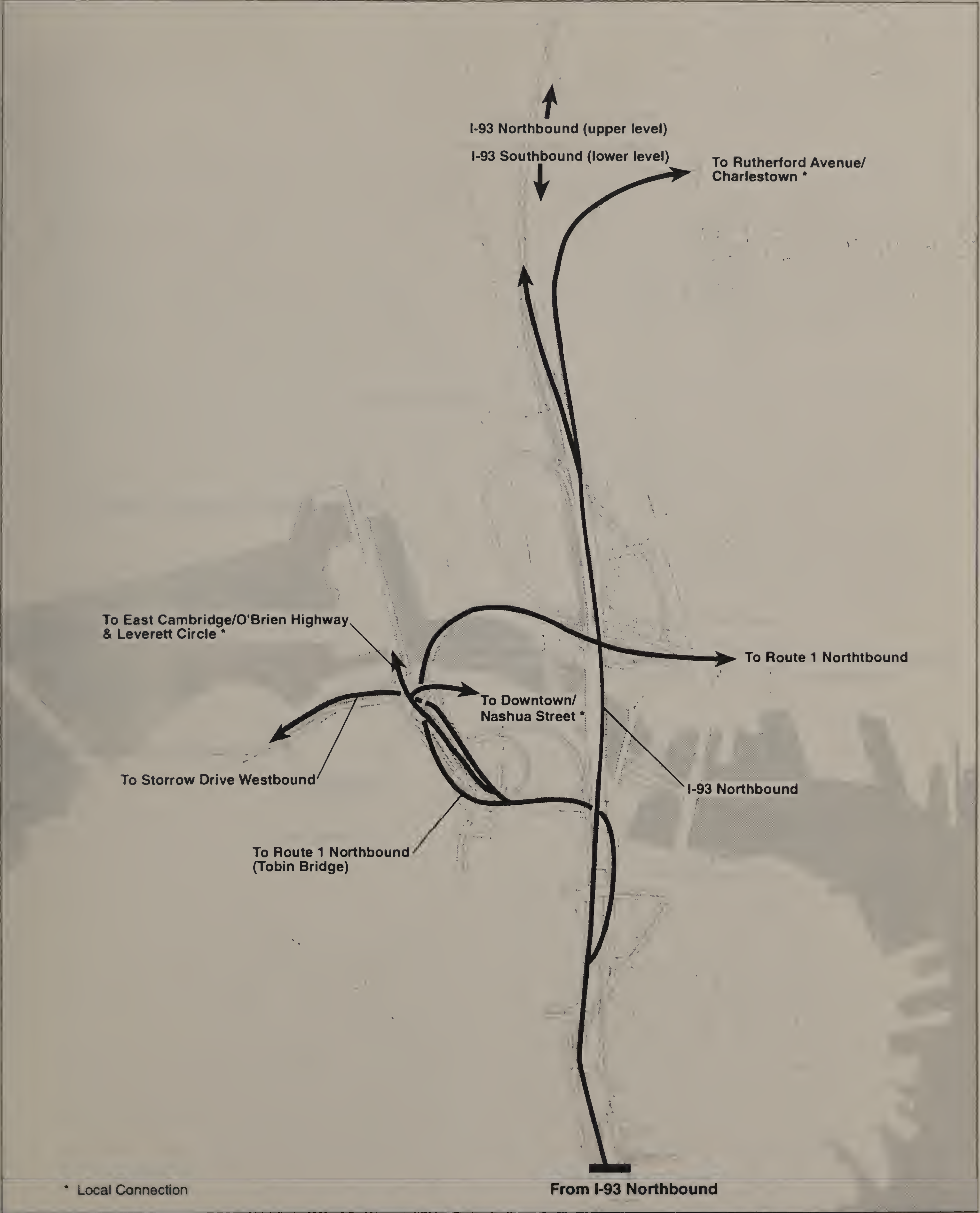

I-93 Northbound (upper level)
I-93 Southbound (lower level)
To Rutherford Avenue/ Charlestown *
To East Cambridge/O'Brien Highway & Leverett Circle *
To Route 1 Northtbound
To Downtown/ Nashua Street *
To Storrow Drive Westbound
I-93 Northbound
To Route 1 Northbound (Tobin Bridge)
* Local Connection
From I-93 Northbound

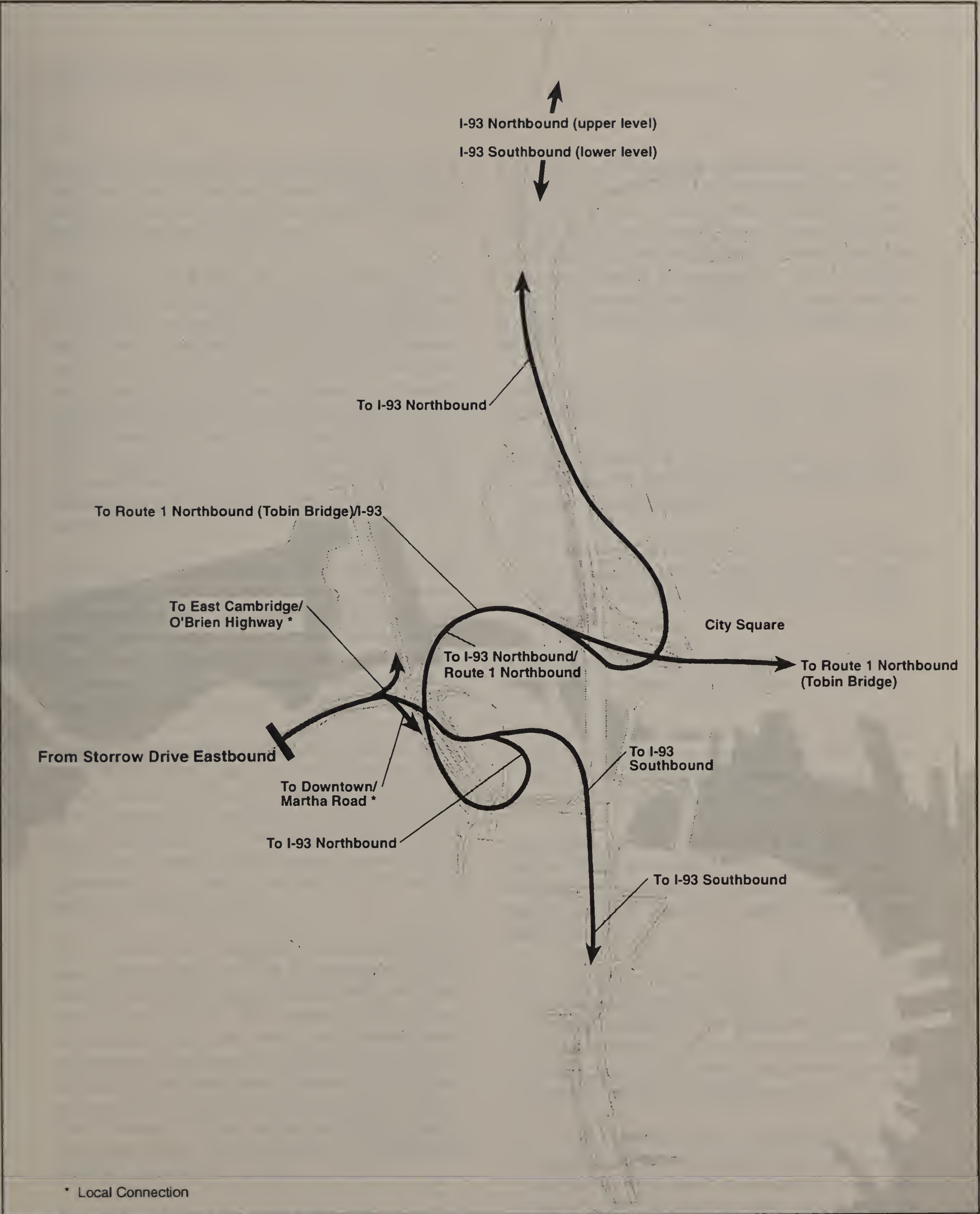
FIGURE 2.24

Travel Routes From I-93 Northbound: Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound
To Route 1 Northbound (Tobin Bridge)/I-93
To East Cambridge/
O'Brien Highway *
City Square
To I-93 Northbound/
Route 1 Northbound
To Route 1 Northbound
(Tobin Bridge)
From Storrow Drive Eastbound
To Downtown/
Martha Road *
To I-93
Southbound
To I-93 Northbound
To I-93 Southbound

* Local Connection

FIGURE

2.25

Travel Routes From Storrow Drive Eastbound: Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET

to the north must begin a tight right-hand curve on a steep downgrade. This curve travels through 270 degrees before merging in the tunnel with traffic from the previously described C-T movement.

Subsequent to the filing of the NPC, and as a result of further design development and review of Alternative 8.1D Mod 5, both MHD and FHWA have determined that the tunnel geometry, particularly of the movements described above, is undesirable compared to other alternatives, including the Preferred Alternative. Negative aspects of the severe tunnel geometry of Alternative 8.1D Mod 5 present the potential to degrade highway safety. The "human factors" associated with the severe geometry include multiple decision points and minimal sight distances, both of which may lead to increased motorist confusion and discomfort.

Traffic Flow: The absence of grade separations of local and regional traffic at Leverett Circle, a major arterial and regional connection to the cities of Boston and Cambridge, impedes traffic flow and causes substantial delays at this vital intersection in Alternative 8.1D Mod 5. In Alternative 8.1D Mod 5, delays at Leverett Circle are approximately twice as long as with the Preferred Alternative. This deficiency is corrected in the Preferred Alternative by constructing an eastbound underpass at Leverett Circle thereby removing from the surface intersection the eastbound Storrow Drive traffic that is travelling to either I-93 northbound or the Tobin Bridge (Route 1) northbound. This feature of the Preferred Alternative allows the intersection to operate at more acceptable levels of service, maintaining vital regional and local traffic access.

Environmental And Aesthetics. The level of improvement in Alternative 8.1D Mod 5 with respect to visual impacts is moderately greater than the Preferred Alternative; however, other environmental impacts, primarily associated with construction period impacts, materials disposal requirements, and extended delay in implementing parkland development, reduce the level of improvement of this alternative when compared to the Preferred Alternative. These impacts are primarily related to the construction of the river tunnel. The following describes these features in detail.

Visual: Viewed from the surroundings, the visual impacts of Alternative 8.1D Mod 5 are moderately less than those of the Preferred Alternative. In Alternative 8.1D Mod 5, the views of the viaducts and bridges are the most discrete. The single bridge structure is narrower than the bridge crossing in the Preferred Alternative; the three ramps merging to two ramps of the Preferred Alternative are only marginally more adverse than the one loop ramp of Alternative 8.1D Mod 5, since the increased footprint of the Preferred Alternative's ramps is offset by a ramp design that uses consistent, parallel profiles.

From the north, Alternative 8.1D Mod 5 provides views that are similar to those of the Preferred Alternative:

- Views entering Boston are framed by the bridge structure, with downtown Boston landmarks clearly visible in both alternatives.

- The cross section through the mainline bridge is symmetrical, and the profile (slope of the deck) is uniform in both 8.1D Mod 5 and the Preferred Alternative.

From the south, Alternative 8.1D Mod 5 provides views that are similar to those of the Preferred Alternative:

- Views leaving Boston are framed by the bridge structure. No distant landmarks are obscured by the mainline or by its appurtenances in either Alternative 8.1D Mod 5 or the Preferred Alternative.

Viewed from the west, Alternative 8.1D Mod 5 has a mainline bridge that causes less visual impact than the Preferred Alternative due to absence of a second bridge structure, but it has more visual impacts due to Project-related buildings:

- While the Storrow Drive connector bridge is an additional element visible from the west in the Preferred Alternative, the alignment and profile of this element make it blend visually with the mainline bridge. As a result, views from upstream are substantially similar in both alternatives.

- The common profiles and simple supporting structures of the loop ramps on the north bank of the Charles River result in substantially similar impacts in both alternatives when viewed from the west.

- Alternative 8.1D Mod 5 can be constructed with either a single ventilation building or two ventilation buildings. If a single ventilation building is constructed, it must be above ground (due to tunnels beneath it), larger, and closer to parkland areas than the ventilation building in the Preferred Alternative. If two ventilation buildings are constructed, an additional building, not present in the Preferred Alternative, will be visible on the north bank of the Charles River.

- The tunneling of Alternative 8.1D Mod 5 requires headhouse enclosures for tunnel egress stairs to be located in the parkland. The Preferred Alternative has none.

Viewed from the east, Alternative 8.1D Mod 5 is similar to the Preferred Alternative.

Aquatics: Due to its river tunnel construction, Alternative 8.1D Mod 5 has greater construction period impacts on Federal and State water resources in the Charles River than the Preferred Alternative. In addition, Alternative 8.1D Mod 5 also has greater construction period impacts to Federal and State aquatic resource areas as a result of tunnel ramp construction under the southern portion of the Millers River. These temporary impacts do not occur with the Preferred Alternative.

Alternative 8.1D Mod 5 results in substantial additional temporary impacts over large areas of river bottom associated with river tunnel construction. These construction period impacts affect an area of the Charles River not affected by the Preferred Alternative (the area between the bascule bridge and the old MDC dam), and include the potential for increased disturbance of contaminated sediments, increased turbidity, increased restrictions on navigation in the lower basin, and interference with fisheries and water-related recreation.

Construction of the river tunnel creates the following specific temporary impacts to the Charles River:

- Dredging of the river bottom and extensive tunneling adds to materials disposal requirements for this alternative, which total over 1 million cy of dredged and excavated material, more than twice that necessary for the Preferred Alternative.

- There is a temporary displacement of 1.4 acres of nontidal waters.

- River tunnel construction has the potential for adverse impact on navigation in the Charles River between the old MDC dam and the bascule bridge (the lower basin) during the 2- to 3-year construction period. Construction impacts in this area are avoided by the Preferred Alternative.

Alternative 8.1D Mod 5 also results in more substantial temporary impacts to the Millers River. The southern banks of the Millers River are affected during the installation of tunnels under the river. These temporary impacts do not occur in the Preferred Alternative.

Parkland: In Alternative 8.1D Mod 5, existing parks are disrupted and planned park development is delayed. Tunnel construction under the Charles River disrupts the Charles River Basin Recreation Area for a period of 2 to 3 years and occupies the entire Nashua Street Park parcel, delaying its development for 4 years while the tunnel and ventilation ducts are constructed. In addition, a corner of the park on the former GSA parcel is occupied during tunnel construction, and the park is disturbed for 2 to 3 years. To support tunnel construction, a 200-foot-wide, 35-foot-deep by 400-foot-long casting basin is required along the northern bank of the Charles River. This not only delays parkland development in this area but also affects the planned private development of the North Point area of East Cambridge.

In contrast, the Preferred Alternative completely avoids physical construction in these areas, allowing for the early implementation of Project mitigation including park construction.

Other: Other environmental and community impacts include the following:

- The 4.5 years longer construction duration for Alternative 8.1D Mod 5 is largely due to the complex multilevel tunnel system south of the Charles River. This extends the duration of construction period impacts on abutting properties, adjacent parklands and both local and regional traffic operations.

- The Alternative 8.1D Mod 5 tunnel in the Charles River is in direct conflict with a 345 kV electrical line, a major multicity, redundant power supply for maintenance of Boston regional electrical reliability. In addition, an 84-inch combined sewer, serving the North Station area, will also be affected. Both facilities will require relocation elsewhere in the Charles River prior to tunnel construction. The Preferred Alternative avoids these impacts in the Charles River, since it does not require multiple sequential construction operations in the river.

2.4.3(c) Refinements

Three design refinements to Alternative 8.1D Mod 5 were described in the 1993 DSEIS/R. The following is a brief description of these refinements as well as reasons why they do not substantially alter the relative impacts and benefits of Alternative 8.1D Mod 5 or the decision to reject it as the preferred alternative.

Redesign Of Leverett Circle/Nashua Street Area: A redesign of the Leverett Circle/Nashua Street Area was developed in an attempt to address both the operational deficiencies at Leverett Circle and the Lomasney/Merrimac Street intersection in Alternative 8.1D Mod 5 as well as the severe impacts associated with the spiraling downgrade tunnel providing connections from Storrow Drive/Leverett Circle to both I-93 and Route 1 North. The Ramp S-N/L-N (Storrow/local-to-north) traffic movements would be realigned to use a common access ramp for both movements. Traffic from Storrow Drive would proceed straight through Leverett Circle to a new signalized intersection along Nashua Street. Local traffic from downtown destined for points north would also proceed to this same intersection. A new two-lane ramp would originate at this point, continue under the Registry building (100 Nashua Street), and turn northerly around the Suffolk County Jail. At this point the tunnel would rejoin the Alternative 8.1D Mod 5 Ramp C-T alignment and would pass under the Charles River as a three-lane tunnel.

This suggested refinement would improve the tightly curved tunnel geometry for Ramp L-N in the Leverett Circle area. An eastbound underpass for Storrow Drive traffic destined for points south would be incorporated in an attempt to improve traffic operations at Leverett Circle. Ramp M-N at the Lowell Square area would also be eliminated, thereby improving traffic operations at this intersection. The Ramp L-N (local-to-north) traffic would access points north via the new intersection.

Improvements offered by this refinement include:

- Due to the reduction in tunnel construction, overall materials disposal requirements would be slightly reduced.

- Traffic operations at Leverett Circle would be satisfactory because the eastbound underpass to the south removes sufficient traffic to allow for adequate traffic signal phasing.

This refinement, however, would maintain many of the negative aspects of Alternative 8.1D Mod 5 such as the long curvilinear tunnels combined with multiple decision and merge points reducing operational safety and increasing driver discomfort. In addition, in order to accommodate the new Nashua Street intersection, which functionally replaces both the M-N and S-N/L-N Ramps, Nashua Street would require realignment. This would require:

- The acquisition of a portion of the Nashua Street parcel, a protected 4(f) resource.

- The acquisition and demolition of the Registry building, a building eligible for inclusion on the National Register of Historic Places; therefore, the Registry building constitutes a Section 4(f) protected resource.

Despite the improvements to traffic operations at Lowell Square and Leverett Circle, the operations at the newly formed Nashua Street on-ramp intersection would be unacceptable due to the capacity constraints of the on-ramp, exacerbated by the tight vertical and horizontal alignments required to merge with other tunnel segments under the Charles River. Because of these additional impacts, this design refinement does not substantially reduce the impacts of Alternative 8.1D Mod 5 nor does the refinement substantially improve traffic operations either locally or regionally over the basic Alternative 8.1D Mod 5.

Single Ventilation Building Versus Two Ventilation Buildings: During design development it was determined that a two-ventilation building design would be more effective to accommodate the river tunnel. The ventilation building on the south bank of the Charles River, although reduced in size, would still need to be constructed above grade. A second ventilation building would be located on the north side of the Charles River adjacent to BSG, similar to that analyzed in the 1993 DSEIS/R for the

Reduced River-Tunnel Alternative. This refinement, if incorporated into Alternative 8.1D Mod 5, does not substantially alter the visual and air quality impacts of Alternative 8.1D Mod 5 compared to the Preferred Alternative.

Bridge Structures: The bridge structure identified in Alternative 8.1D Mod 5 is a single twin-legged tower cable-stayed bridge carrying ten lanes of traffic. During subsequent conceptual design development a two-tower cable-stayed bridge was introduced which is characterized by lower overall tower height and diamond-shaped towers carrying eight lanes between the tower legs and an additional two lanes cantilevered on the westerly side of the towers. This conceptual design could be applied to any of the proposed 10-lane or 12-lane bridge crossings. The ability to incorporate this refinement into Alternative 8.1D Mod 5 did not affect the alternative selection process in that conceptual bridge design does not substantially alter the impacts of this alternative compared to the Preferred Alternative.

2.4.3(d) Conclusion

As explained in the 1992 NPC and 1993 DSEIS/R, Alternative 8.1D Mod 5 represents a substantial improvement to Scheme Z, in terms of aesthetic impacts to the Lower Charles River Basin and to the abutting communities. The marginal aesthetic improvement as compared to the Preferred Alternative, however, is outweighed by the safer and more efficient highway and street operations, avoidance of certain protected resource areas, the substantially shorter construction duration, and the opportunity for substantially earlier park development associated with the Preferred Alternative.

2.4.4 Reduced River-Tunnel Alternative

The Reduced River-Tunnel Alternative was developed in response to concerns expressed by FHWA about Alternative 8.1D Mod 5 regarding traffic operations at Leverett Circle and operational safety in its river tunnel. USACE expressed additional concerns regarding impacts of tunnel construction in the Charles River. In response to these concerns, the Reduced River-Tunnel Alternative removes the Central Artery to Tobin Bridge movement from tunnel and places it on a viaduct structure by adding two lanes to the mainline bridge. The Reduced River-Tunnel Alternative features two loop ramps in East Cambridge and a single 12-lane bridge across the Charles River. (See Figure 2.26 for structures and 2.27 through 2.30 for main travel routes.)

2.4.4(a) Description

The Reduced River-Tunnel Alternative features a 12-lane bridge supported with two towers, one on each side of the river; and two loop ramps in East Cambridge. The two-lane northbound tunnel under the Charles River requires one ventilation building, constructed at grade, on the north side of the river. This ventilation building is located adjacent to BSG and is surrounded by two viaduct loops. The land-based tunnels under the North Station commuter railroad tracks require a second ventilation building on the south side of the Charles River, constructed below grade, with exhaust stacks and fresh air intake stacks extending above. Roadway links are provided in Section 2.4.2 of the 1993 DSEIS/R.

2.4.4(b) Reasons For Rejection

Like Alternative 8.1D Mod 5, the Reduced River-Tunnel Alternative satisfies many of the objectives listed in Section 2.2; however, in comparison with the Preferred Alternative, this alternative does not provide the level of overall improvement achieved by the Preferred Alternative. Key considerations that led to the rejection of the Reduced River-Tunnel Alternative include:

Traffic Operations And Safety: The Reduced River-Tunnel Alternative's level of improvement to traffic operations and safety is not as high as that of the Preferred Alternative, primarily because of issues related to access to and from the local and regional highway systems.

Operationally, the Reduced River-Tunnel Alternative closely resembles the Preferred Alternative with the exception of the eastbound Storrow Drive and Leverett Circle local to I-93 northbound and Tobin Bridge (Route 1) northbound (S/L-N/T) movements. In the Reduced River-Tunnel Alternative, these connections are made via a direct two-lane river tunnel as opposed to the two-lane viaduct of the Preferred Alternative. Operationally, the primary difference is exhibited in how local traffic accesses the northbound regional highway system from East Cambridge, Beacon Hill, and the North Station area. With the Reduced River-Tunnel Alternative, local traffic from Beacon Hill (Charles Circle) and East Cambridge is precluded from accessing the northbound tunnel at Leverett Circle due to the inability to merge with the relatively deep underpass of Leverett Circle accommodating eastbound Storrow Drive traffic with destinations

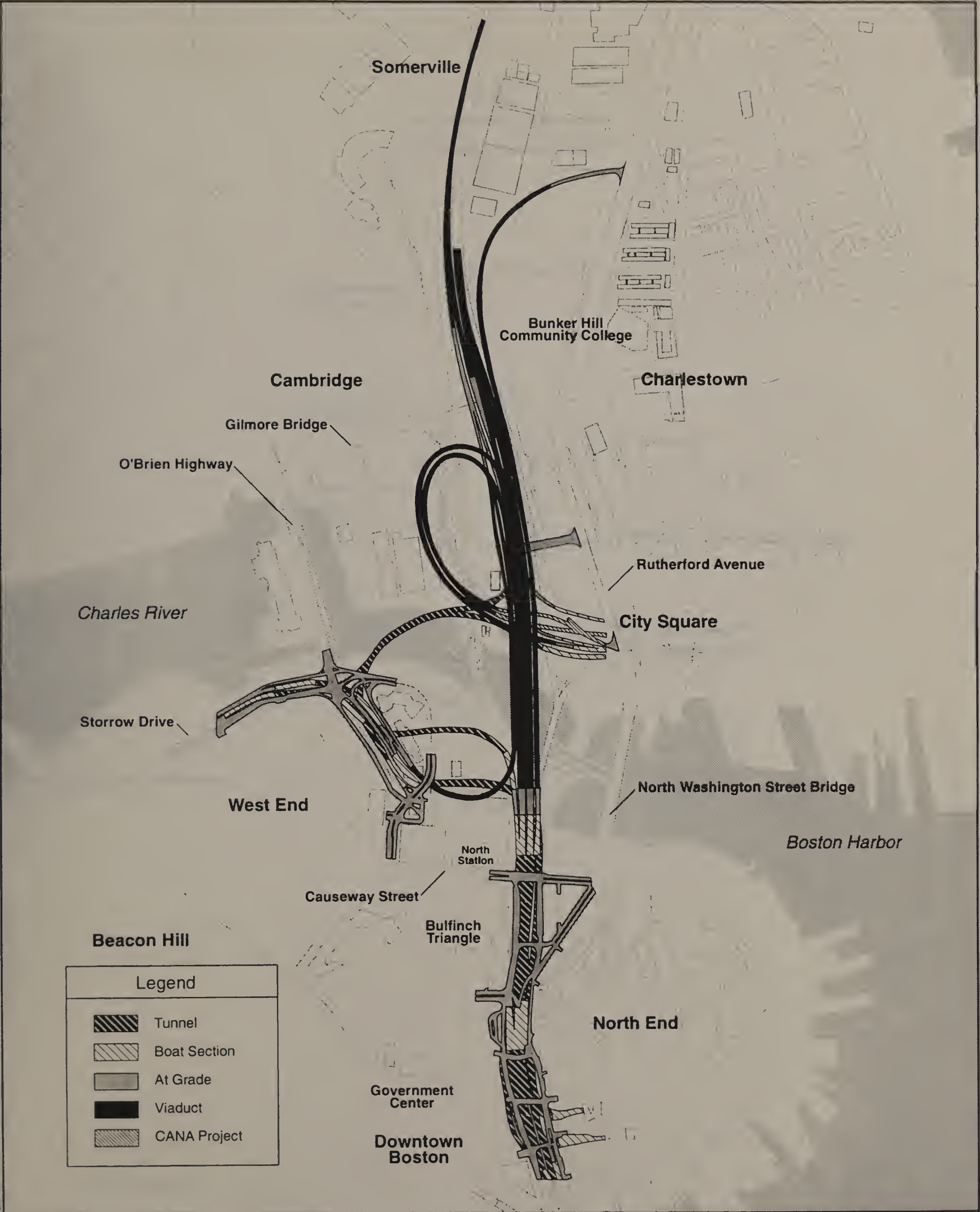

Somerville
Bunker Hill Community College
Cambridge
Charlestown
Gilmore Bridge
O'Brien Highway
Rutherford Avenue
Charles River
City Square
Storrow Drive
North Washington Street Bridge
West End
Boston Harbor
North Station
Causeway Street
Bulfinch Triangle
Beacon Hill
North End
Government Center
Downtown Boston
Legend
▨ Tunnel
▨ Boat Section
▩ At Grade
■ Viaduct
▨ CANA Project

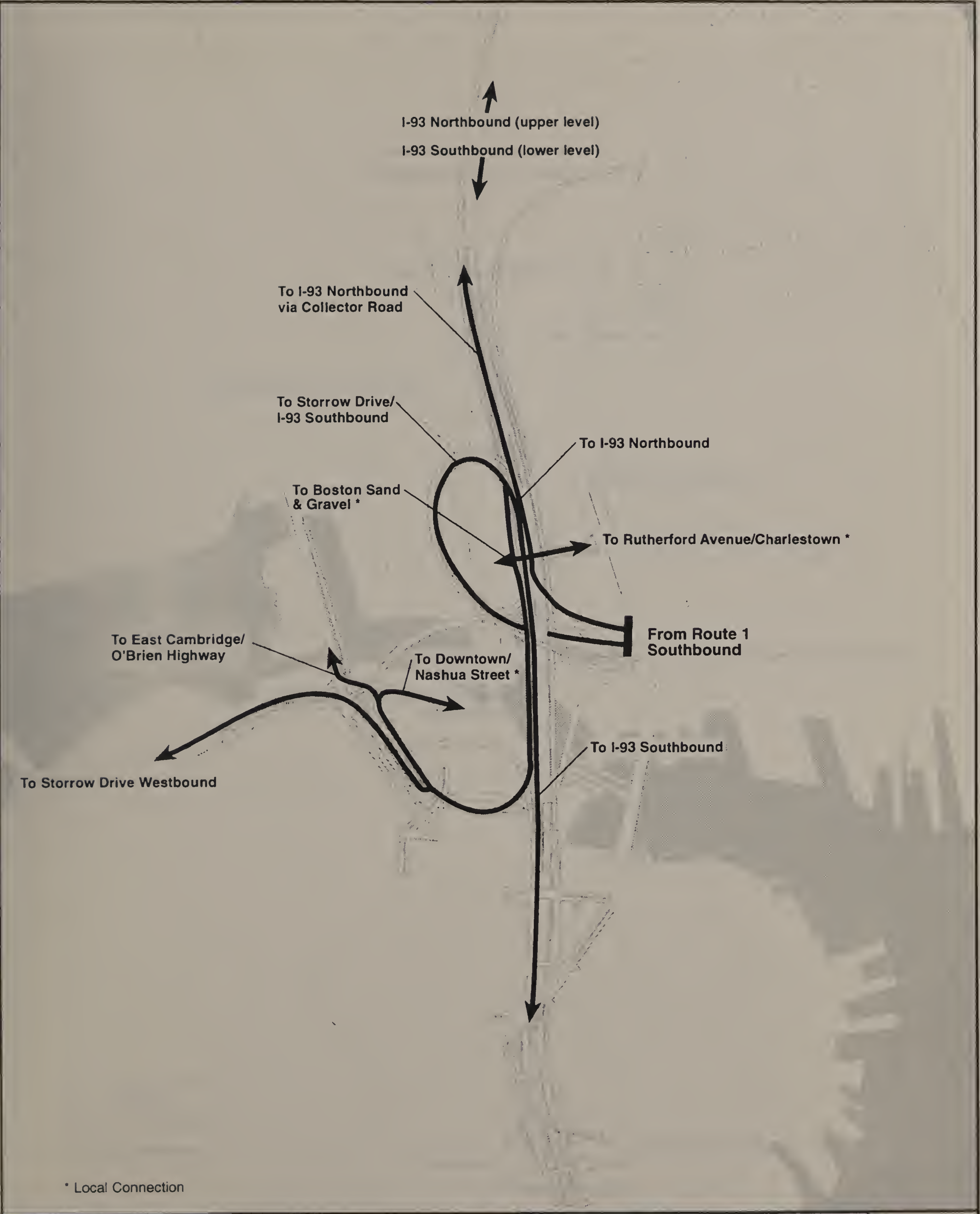
FIGURE 2.26

Reduced River-Tunnel Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound via Collector Road
To Storrow Drive/ I-93 Southbound
To I-93 Northbound
To Boston Sand & Gravel *
To Rutherford Avenue/Charlestown *
From Route 1 Southbound
To East Cambridge/ O'Brien Highway
To Downtown/ Nashua Street *
To I-93 Southbound
To Storrow Drive Westbound

* Local Connection

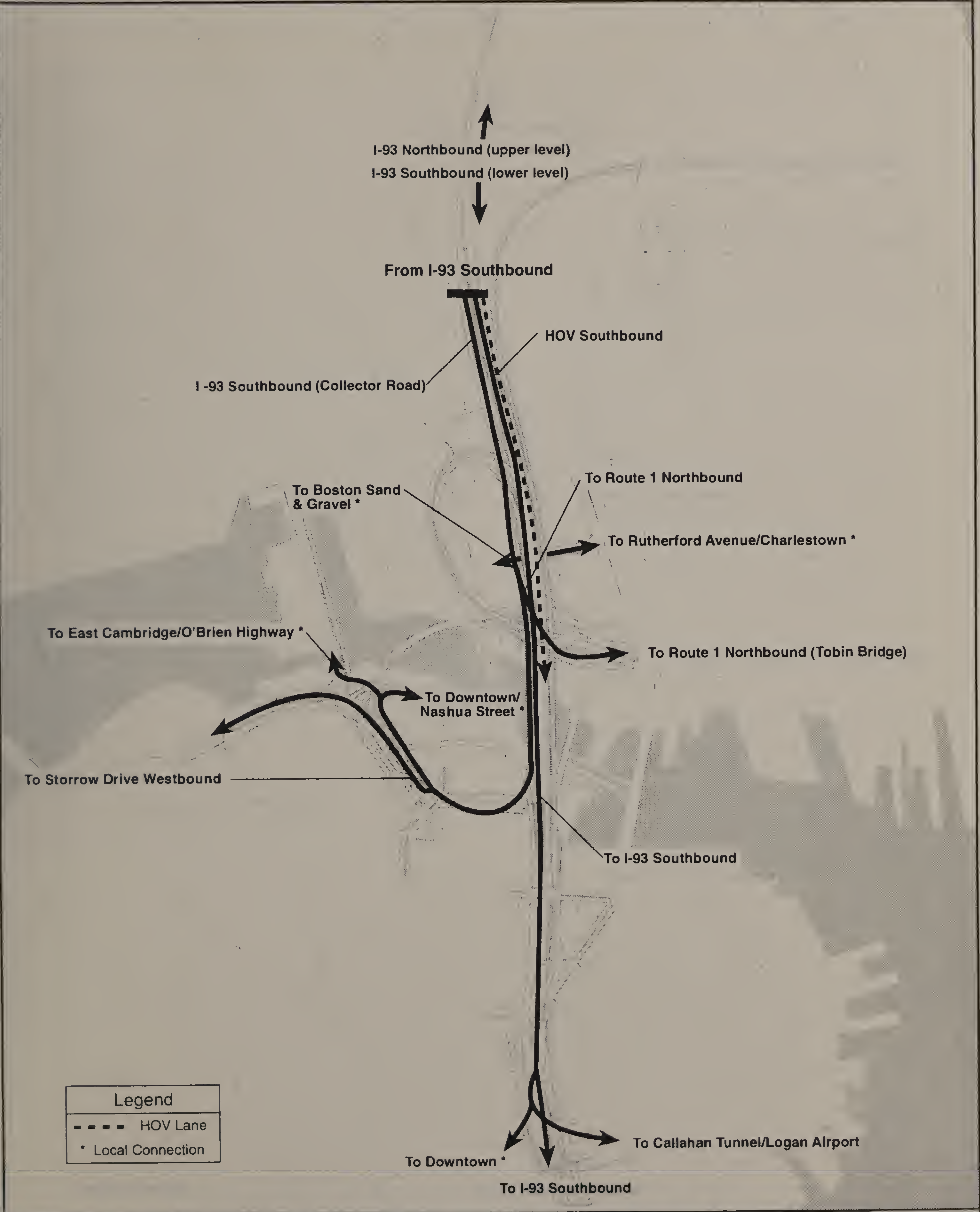
FIGURE 2.27

Travel Routes From Route 1 Southbound: Reduced River-Tunnel Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
From I-93 Southbound
HOV Southbound
I -93 Southbound (Collector Road)
To Route 1 Northbound
To Boston Sand & Gravel *
To Rutherford Avenue/Charlestown *
To East Cambridge/O'Brien Highway *
To Route 1 Northbound (Tobin Bridge)
To Downtown/ Nashua Street *
To Storrow Drive Westbound
To I-93 Southbound
Legend
HOV Lane
* Local Connection
To Callahan Tunnel/Logan Airport
To Downtown *
To I-93 Southbound

FIGURE

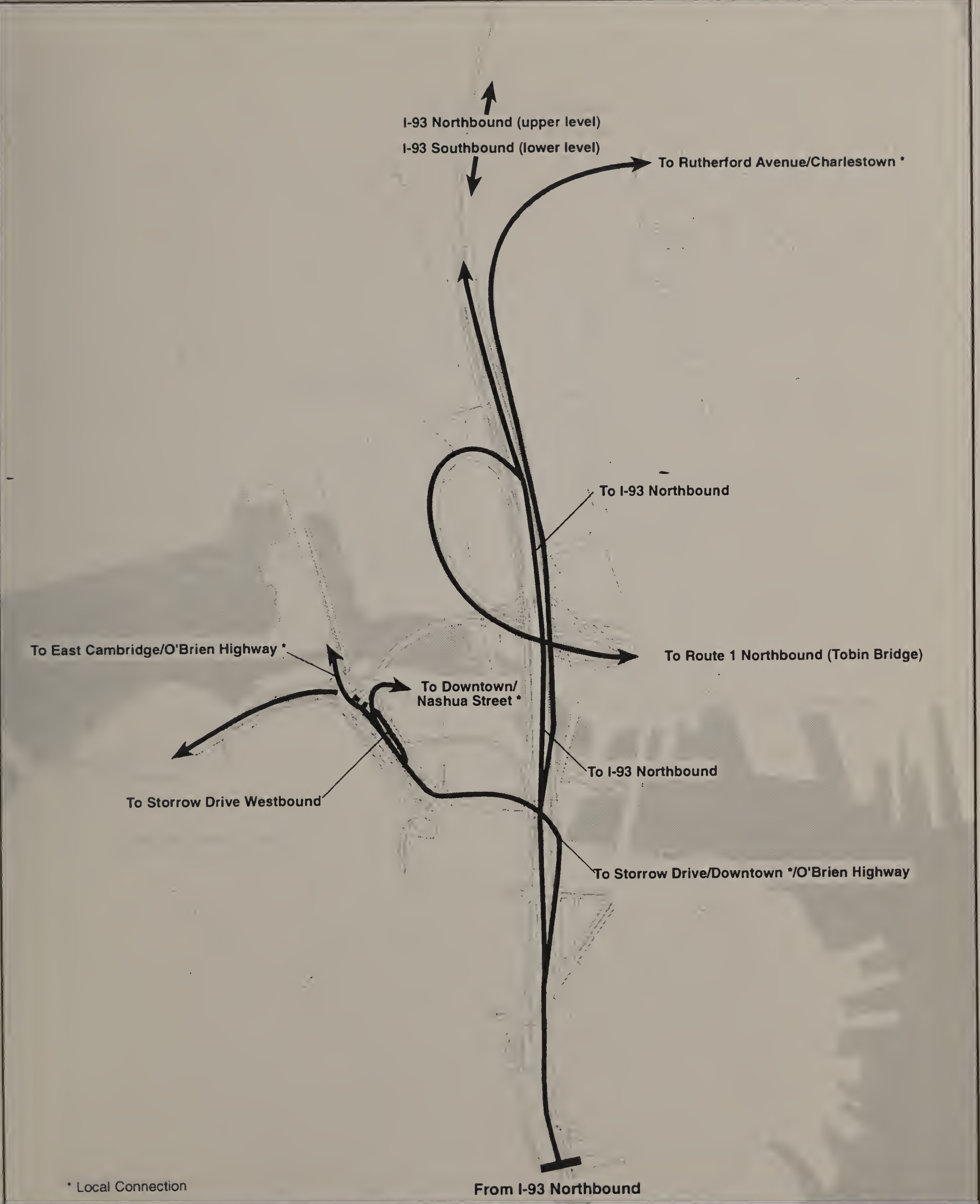
2.28

Travel Routes From
I-93 Southbound:
Reduced River-Tunnel Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
To Rutherford Avenue/Charlestown *
To I-93 Northbound
To East Cambridge/O'Brien Highway *
To Route 1 Northbound (Tobin Bridge)
To Downtown/ Nashua Street *
To I-93 Northbound
To Storrow Drive Westbound
To Storrow Drive/Downtown */O'Brien Highway
From I-93 Northbound

* Local Connection

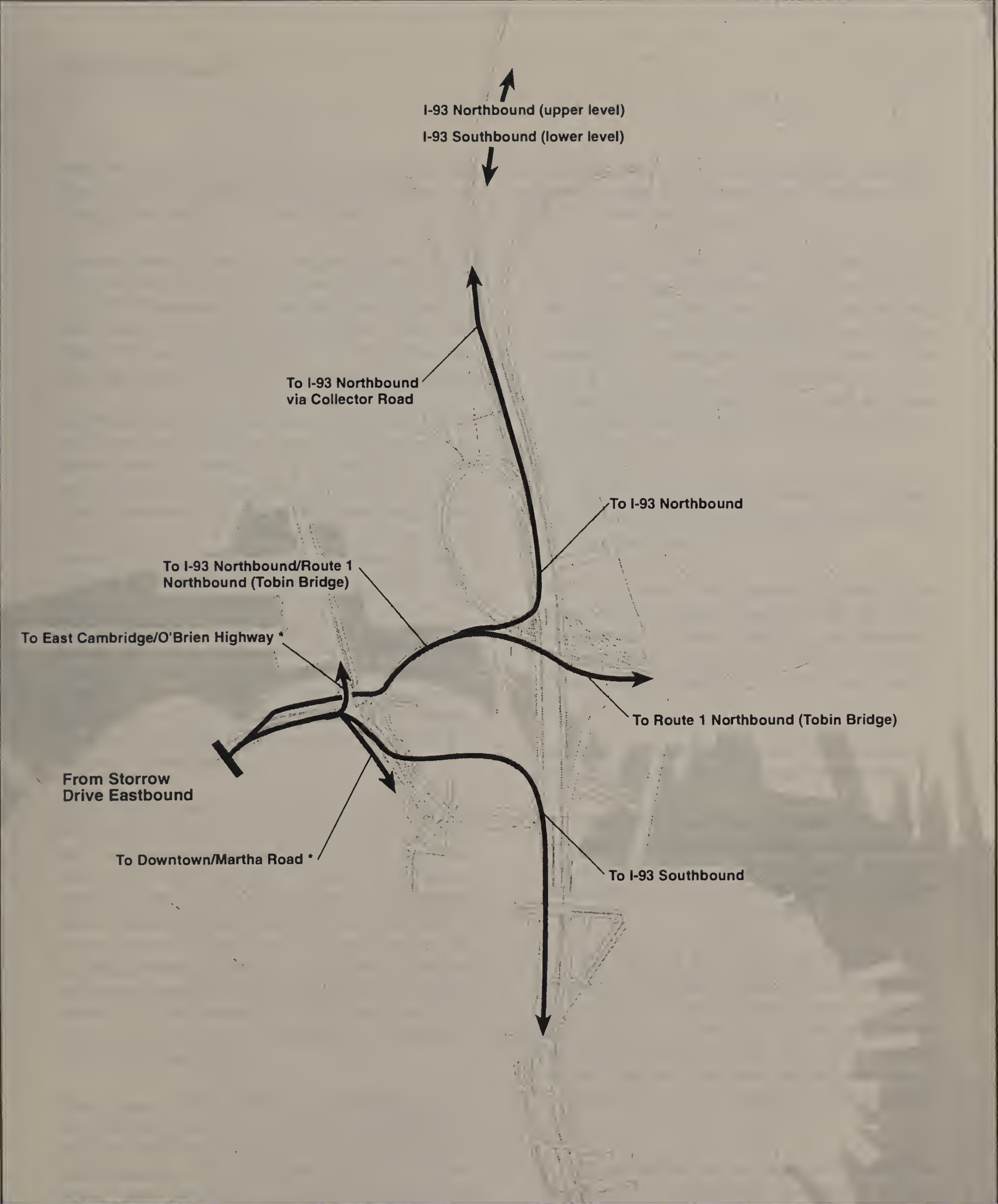
FIGURE 2.29

Travel Routes From I-93 Northbound: Reduced River-Tunnel Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET


I-93 Northbound (upper level)
I-93 Southbound (lower level)
To I-93 Northbound via Collector Road
To I-93 Northbound
To I-93 Northbound/Route 1 Northbound (Tobin Bridge)
To East Cambridge/O'Brien Highway *
To Route 1 Northbound (Tobin Bridge)
From Storrow Drive Eastbound
To Downtown/Martha Road *
To I-93 Southbound

* Local Connection

FIGURE 2.30

Travel Routes From Storrow Drive Eastbound: Reduced River-Tunnel Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 250 500 750 1000 1250 1500 FEET

north of the river. As a result, an access ramp (M-N) is located at the Lomasney Way, Merrimac Street, and Nashua Street intersection (Lowell Square).

This configuration forces traffic originating from Charles Circle and Beacon Hill to utilize Cambridge Street, via a series of left-hand turns, to access the northbound regional highway system at Lowell Square. Adding this high-volume movement to Lowell Square further degrades operations at this already congested intersection.

Like Beacon Hill traffic, motorists seeking access to the north from East Cambridge cannot access the highway system directly at Leverett Circle. These important access restrictions are removed in the design of the Preferred Alternative by providing full-access ramps to the highway system, both northbound and southbound, at Leverett Circle. In the Preferred Alternative, access is achieved at this location from all key points including East Cambridge and Beacon Hill directly from Leverett Circle, Charles River Park and the West End, and North Station via Nashua Street, and Storrow Drive via the eastbound Leverett Circle underpass. The Preferred Alternative also eliminates the need for an on-ramp at Lowell Square (M-N), thereby enhancing the opportunity to resolve traffic and pedestrian congestion at this important intersection.

Environmental and Aesthetic Impacts: The visual impacts of the Reduced River-Tunnel Alternative represent a marginal improvement on the overall appearance of the Preferred Alternative. Impacts of the above-ground elements of the Reduced River-Tunnel Alternative are slightly reduced compared to the Preferred Alternative due to the latter's second bridge structure. Underground element impacts of the Reduced River-Tunnel Alternative are somewhat increased due to the greater amount of tunnel construction and in particular river tunnel construction that is required, when compared to the Preferred Alternative.

Visual Impacts: Viewed from the surroundings, the visual impacts of the Reduced River-Tunnel Alternative are either equivalent to or more adverse than the Preferred Alternative. In the Reduced River-Tunnel Alternative, views of bridges and viaducts are similar to the Preferred Alternative with the addition of a second bridge. The loop ramps in the area adjacent to the parkland are similar to the Preferred Alternative.

Viewed from the north, the Reduced River-Tunnel Alternative provides the following visual comparisons to those of the Preferred Alternative:

- At 12 lanes and a width of 240 feet, the Reduced River-Tunnel Alternative mainline bridge is the widest of the alternatives studied. The Preferred Alternative mainline bridge is approximately 40 feet narrower, and therefore reduces the mass of the main structure. This reduction in the mainline bridge width is offset by the need for a second and separate Storrow Drive connector bridge for the Preferred Alternative.

- Views entering Boston are framed by the bridge structure with downtown landmarks clearly visible in both alternatives.

- The Storrow Drive connector viaduct of the Reduced River-Tunnel Alternative near the rear of the New Boston Garden has similar or marginally lessened visual impacts than the similar Storrow Drive connector viaduct of the Preferred Alternative.

Viewed from the south, the Reduced River-Tunnel Alternative provides the following visual comparisons:

- Views leaving Boston are framed by the bridge structure. No distant landmarks are obscured by the mainline or by its appurtenances in either the Reduced River-Tunnel Alternative or the Preferred Alternative.

- The Reduced River-Tunnel Alternative would requires two ventilation buildings, one on each bank. The building on the north bank presents a new visual element to motorists and pedestrians, due to the height of the stacks. The Preferred Alternative requires only one ventilation building, built mostly below ground, on the south bank of the Charles River.

- Tunnel egress stair enclosures are visible in the parkland; none is required in the Preferred Alternative.

- One mainline bridge is required in the Reduced River-Tunnel Alternative; two bridges (mainline and

Storrow Drive connector) are required in the Preferred Alternative.

Viewed from the east, the visual impacts of the Reduced River-Tunnel Alternative are comparable to the Preferred Alternative.

Viewed from the west, the Reduced River-Tunnel Alternative provides the following comparisons:

- While the Storrow Drive connector bridge is an additional element visible from the west in the Preferred Alternative, the alignment and profile of this element make it blend visually with the mainline bridge. As a result, views from upstream are substantially similar in both alternatives.

- The common profiles and simple supporting structures of the loop ramps on the north bank of the Charles River result in substantially similar impacts in both alternatives when viewed from the west (see Figure 2.31).

- The north bank ventilation building is added to views. The Preferred Alternative has no ventilation building on the north bank.

- At the Nashua Street and Lomasney Way intersection, the Reduced River-Tunnel Alternative does not provide for a developable parcel abutting Nashua Street, while the Preferred Alternative provides for this development. The development makes an important contribution to the visual continuity of Nashua Street and surrounding land uses.

Aquatics: With the Reduced River-Tunnel Alternative, as with Alternative 8.1D Mod 5, tunnel construction will result in greater temporary impacts on Federal and State water resources in the Charles River than the Preferred Alternative. The Reduced River-Tunnel Alternative also has construction impacts to Federal and State aquatic resource areas as a result of tunnel ramp construction under the southern portions of the Millers River. These impacts do not occur with the Preferred Alternative.

As with Alternative 8.1D Mod 5, and due to the construction of the river tunnel, the Reduced River-tunnel Alternative also results in substantial additional temporary impacts over large areas of river bottom. The types of impacts are the same as with Alternative 8.1D Mod 5, including the potential for increased disturbance of contaminated sediments, increased turbidity, increased restrictions on navigation in the lower basin, and interference with fisheries and water-related recreation.

The Reduced River-Tunnel Alternative creates the following specific temporary impacts to the Charles River:

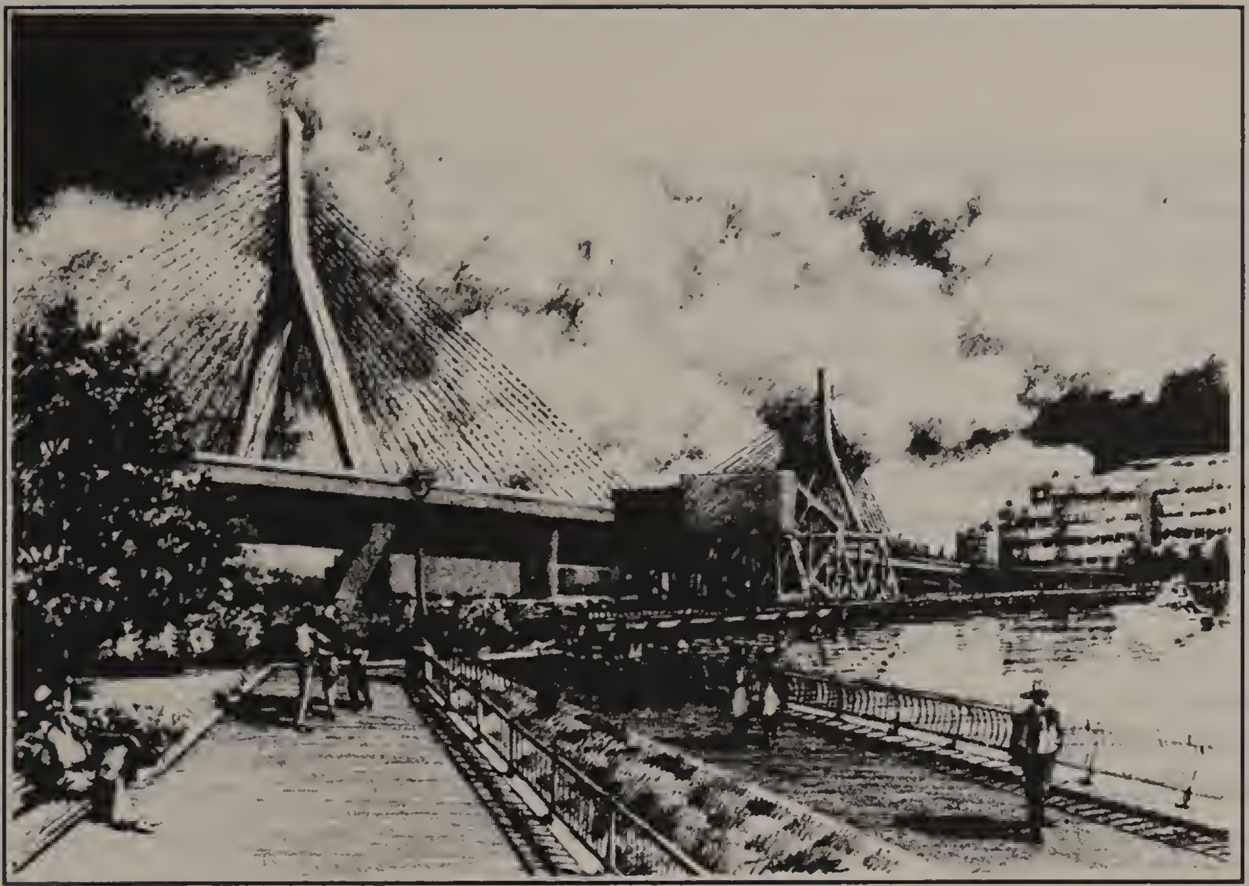
- Dredging river bottom and extensive tunneling adds to materials disposal requirements for this alternative, which total approximately 750,000 cy of dredged and excavated material, 50 percent more than with the Preferred Alternative.

- There is a temporary displacement of 1.4 acres of nontidal waters.

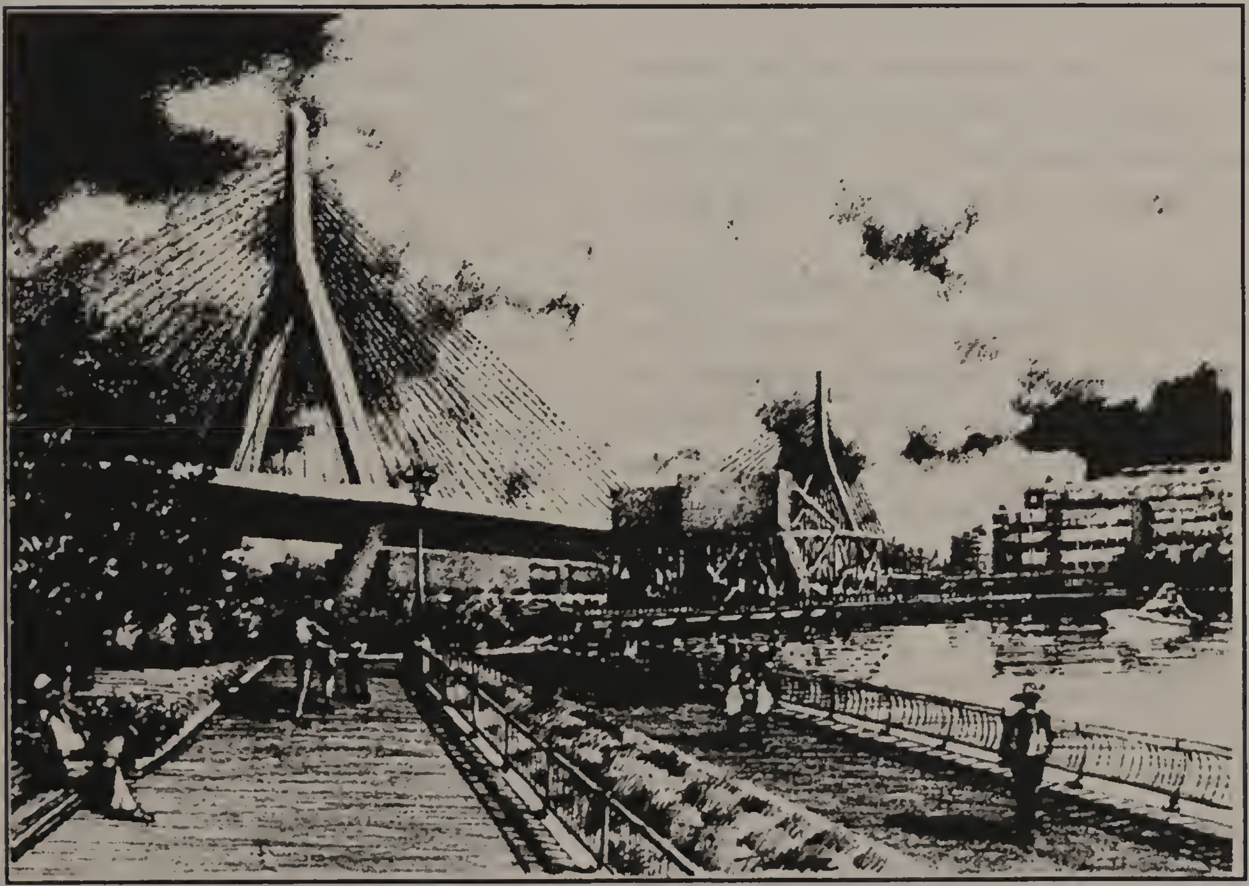
- River tunnel construction has the potential for adverse impacts on navigation in the Charles River between the old MDC dam and the bascule bridge (the lower basin) during the 2- to 3-year construction period. Construction impacts in this area are avoided by the Preferred Alternative.

The Reduced River-Tunnel Alternative also results in substantial temporary impacts to the Millers River due to the placement of bridge piers and fill for access ramps in the river. Additional banks of the Millers River are potentially altered to construct the S-T and S-N ramps across the river in its southerly and central portions.

Parkland Impacts: With the Reduced River-Tunnel Alternative, as with Alternative 8.1D Mod 5, expansion and improvement of Charles River parkland and open space is similar to that associated with the Preferred Alternative, but implementation of parkland mitigation is disrupted and delayed. Tunnel construction under the Charles River disrupts the lower basin recreation area for a period of at least 3 years and occupies much of the Nashua Street Park parcel, delaying its development until the tunnel construction is completed. In addition, a corner of the park on the former GSA parcel is occupied during tunnel construction, similarly affecting this parcel. The Preferred Alternative, by contrast, completely avoids physical construction in these protected resource areas, allowing for the early implementation of Project mitigation including park development. The Reduced River-Tunnel Alternative requires the construction of a 200-foot-wide, 35-foot-deep by 100-foot-long casting basin along the north bank of the Charles River. This not only



Preferred Alternative



Reduced River-Tunnel Alternative

FIGURE

2.31

View of Charles River Bridge from North Bank Looking East: Preferred Alternative and Reduced River-Tunnel Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

delays parkland development in this area but also affects the planned private development of the North Point area of East Cambridge.

Other Impacts: Other environmental and community impacts include:

- As with Alternative 8.1D Mod 5, the extensive tunnel construction required by the Reduced River-Tunnel Alternative extends the duration of construction impacts on abutting properties, adjacent parklands, and local and regional traffic operations.
- The Reduced River-Tunnel Alternative tunnel in the Charles River is in direct conflict with an 84-inch combined sewer serving the North Station area. This facility will require relocation elsewhere in the Charles River prior to tunnel construction. The Preferred Alternative avoids this impact in the Charles River.

2.4.4(c) Refinements

The following four refinements to the Reduced River-Tunnel Alternative were suggested and identified in the 1993 DSEIS/R and evaluated in preparation of this FSEIS/R in an attempt to address certain deficiencies of this alternative.

Redesign Of Leverett Circle/Nashua Street Area: The refinement described for Alternative 8.1D Mod 5 which involves a redesign of the Leverett Circle/Nashua Street area, and attempts to address traffic operations at Leverett Circle and at the nearby Lowell Square area, can also be applied to the Reduced River-Tunnel Alternative (refer to Section 2.4.3(c)). Due to the impacts of this refinement, as previously described in Section 2.4.3(c), this refinement is not considered an improvement to the Reduced River-Tunnel Alternative.

I-93 Northbound Right-Hand Exit: This refinement can be applied equally to the Reduced River-Tunnel and the Preferred Alternative due to the identical design of northbound I-93 facilities in both designs. Refer to Section 2.4.1(b) for a description of this refinement and reasons for its rejection.

Realignment Of The River Tunnel: This refinement involves a realignment of the river tunnel into the transportation corridor between the railroad bascule bridge and the proposed mainline I-93 bridge in a similar horizontal alignment to the Preferred Alternative (see Figure 2.32). In response to comments, this realignment, which moves tunnel construction out of the recreational portion of the Charles River upstream of the railroad, was evaluated during preparation of this FSEIS/R.

As with the Reduced River-Tunnel Alternative, and due to the construction of the river tunnel, the Realigned Reduced River-Tunnel Alternative also results in substantial additional temporary impacts over large areas of river bottom.

Operationally this refinement would function in a similar manner to the Preferred Alternative including improving local access to the highway system from the Leverett Circle area.

The tunnel would pass under the North Station railroad platforms, then under the Charles River between the MBTA bascule railroad bridge and the existing I-93 truss bridge. The S-T (Storrow-to-Tobin) and S-N (Storrow-to I-93 northbound) traffic movements would be accommodated in the tunnel. A portion of a third loop viaduct (which merges into the C-T loop ramp) is required as with the Preferred Alternative. The loop ramp structures have the same visual appearance and function as the loop ramps in the Preferred Alternative.

This refinement to the Reduced River-Tunnel achieves only incremental improvements to the visual impacts of the Preferred Alternative. The loop ramp systems on the north bank of the Charles River are identical for the two alternatives. The bridge crossing in this refinement is identical to that of the Reduced River-Tunnel Alternative and is therefore similar to the Preferred Alternative as discussed in Section 2.4.4(b).

The realigned refinement of the Reduced River-Tunnel Alternative was rejected for many of the same reasons as the alternative upon which it is based, especially for temporary aquatic and other construction period impacts which are more severe than the Reduced River-Tunnel.

The major reasons for the rejection of the realigned refinement are listed below:

- Blasting in the Charles River, which would likely be required for tunnel construction, east of the bascule bridge not only would have aquatic impacts but also hydraulic impacts, the latter potentially affecting the flood control pumps at the nearby Charles River Dam.

- Due to the construction of the river tunnel, the realigned version of the Reduced River-Tunnel Alternative also results in substantial additional temporary impacts over a large area of river bottom in comparison to the Preferred Alternative. The types of impacts are the same as with the Reduced River-Tunnel Alternative, including the potential for increased disturbance of contaminated sediments, increased turbidity, increased restriction on navigation in the lower basin, and interference with fisheries and water-related recreation.

- A protective structure would have to be constructed over the proposed alignment of the North Station/South Station rail link, which would be bored through under the same general alignment as the roadway river tunnel. This will not be required by the Preferred Alternative, which will allow greater flexibility for the design of this proposed transportation project.

- This refinement would require excavation of the entire Millers River for a casting basin to construct and float immersed tube tunnel sections into the Charles River. Additional wetlands would be affected compared to the Preferred Alternative.

- The proximity of the MBTA Orange Line tunnel near the roadway tunnel would add construction difficulties and risk over those of the Preferred Alternative.

- Tunnel construction has substantially greater impacts to the confined navigation channel between the bascule bridge and Charles River Dam locks. The bridge construction of the Preferred Alternative causes fewer restrictions.

- The deep river-tunnel profile of this refinement requires building deeper land-based tunnels in the railroad yard behind North Station, increasing underpinning and materials disposal burdens as compared to the Preferred Alternative.

- Additional construction work associated with river and land-based tunnels would extend the construction duration 2 years compared to the Preferred Alternative.

Viewed from the surroundings the visual impacts of the realigned version of the Reduced River-Tunnel Alternative are equivalent in most respects to those described for the Reduced River-Tunnel Alternative.

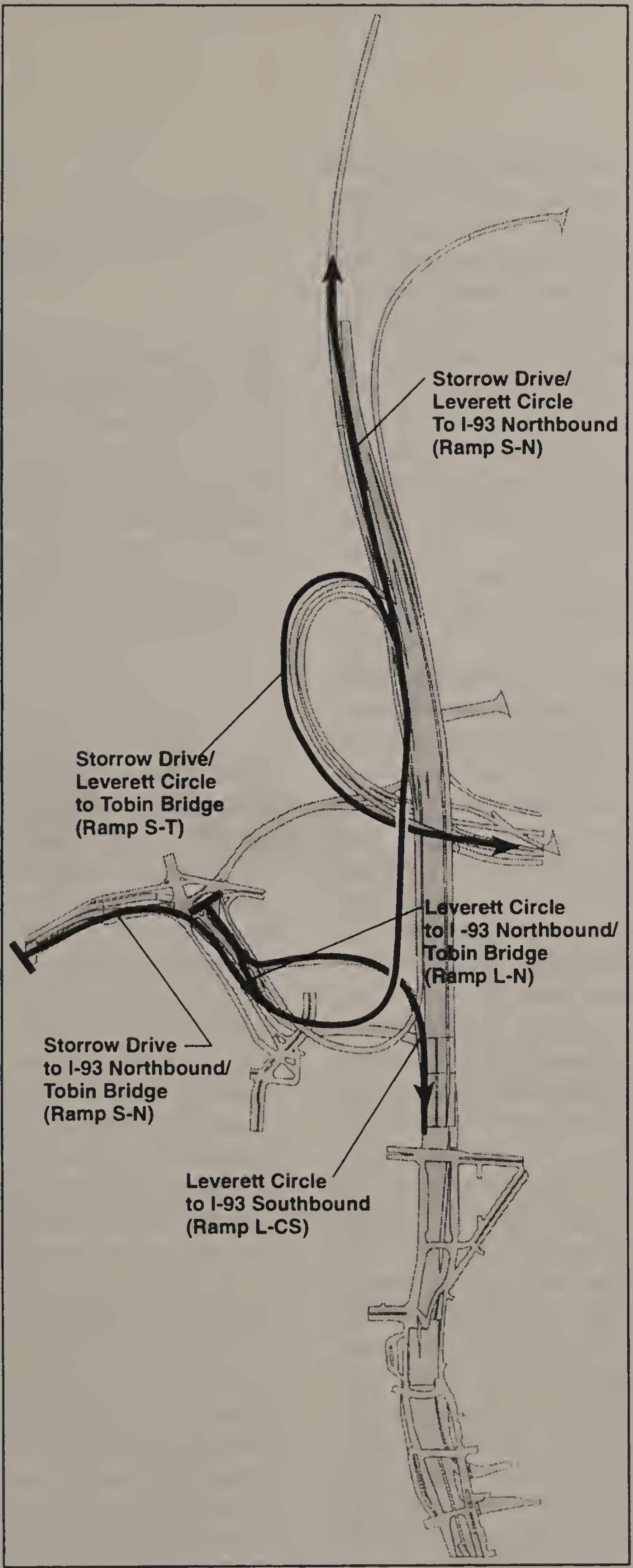
Two-Way River Tunnel: The purpose of the two-way river tunnel design refinement of the realigned Reduced River-Tunnel Alternative is to remove Ramp N-S (I-93 southbound to Storrow Drive) from viaduct, thereby decreasing the width of the mainline bridge across the Charles River and improving aesthetics. The alignment of Ramp N-S passes under the Charles River, turns right under the North Station commuter railroad tracks, passes under the southwest corner of the Registry building and meets the existing underpass at Leverett Circle. To accommodate a connection from the Tobin Bridge (Ramp T-S), the CANA loop ramp geometry moves westerly, affecting the MWRA pumping facility and the North Point development area. This is a result of Ramp T-S having to diverge from Ramp T-C much earlier to enter into a tunnel.

Although this refinement results in a single, ten-lane mainline bridge across the Charles River, it was rejected based on the impacts associated with tunnel construction in the Charles River: the complexity of accommodating a wider tunnel, a bridge, and a rail link all in the same transportation corridor; and the additional construction duration. Also, further study of this refinement indicates that only an incremental, if any, aesthetic advantage exists for the Crossing. In this case the advantage of a single ten-lane bridge is offset by the need for an additional loop ramp in East Cambridge, compared to the Preferred Alternative. In addition:

- The proximity of the MBTA Orange Line tunnel near the roadway tunnel would complicate construction difficulties for the latter.

- Construction would be very close to the navigation channel at the bascule bridge and Charles River Dam locks, increasing impacts to navigation during construction over the other alternatives under review.

- The deep river tunnel profile would require building deeper land-based tunnels in the railroad yard behind North Station, increasing underpinning and


Storrow Drive/ Leverett Circle To I-93 Northbound (Ramp S-N)
Storrow Drive/ Leverett Circle to Tobin Bridge (Ramp S-T)
Leverett Circle to I -93 Northbound/ Tobin Bridge (Ramp L-N)
Storrow Drive to I-93 Northbound/ Tobin Bridge (Ramp S-N)
Leverett Circle to I-93 Southbound (Ramp L-CS)

FIGURE

2.32

Realigned Reduced River Tunnel Refinement

Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 800 1000 FEET

materials disposal burdens.

- The wider river tunnel would require additional dredged material to be disposed.

2.4.4(d) Conclusion

While the incorporation of design refinements into the Reduced River-Tunnel Alternative would eliminate the impediments to early parkland development, they would not materially lessen the impacts nor improve overall performance with respect to traffic operations and safety, other environmental impacts, or constructibility when compared to the Preferred Alternative. For these reasons, the Reduced River-Tunnel Alternative and its refinements were rejected in favor of the Preferred Alternative.

2.5 CONCLUSION

The identification of the Preferred Alternative resulted from a comparison of the strengths and weaknesses of Scheme Z and the three alternative designs for the Charles River Crossing with relation to the established goals and objectives. As noted in the MEPA Certificate of October 15, 1993, on the DSEIS/R, and confirmed by the preceding discussion, the relative impacts and benefits of the three design alternatives do not significantly differ enough from one another to signal an obvious choice based upon environmental impact only. The following discussion is a summary of this comparison and of the rationale used in the identification process.

Traffic Operations And Safety. Traffic flow and safety of operations are the primary Project objectives used to assess the transportation performance of the alternatives. The Preferred Alternative improves upon the traffic operations and safety performance of Scheme Z in two significant ways. First, the Preferred Alternative eliminates the double river crossing for traffic movements to and from Storrow Drive/Leverett Circle contained in Scheme Z. Second, the Preferred Alternative incorporates an HOV lane on I-93 southbound, while Scheme Z does not. Both of these actions significantly improve the operation of the local highway network, and reduce the vehicle miles of travel within the Project area.

In comparison to Alternative 8.1D Mod 5, the Preferred Alternative fully addresses the Federal Highway Administration concerns with the tunnel alignment. FHWA commented that the alignment proposed for Alternative 8.1D Mod 5 was undesirable due to its length and indirect routing. Of additional concern to FHWA is the potential for creating an unsafe operating environment in that the circuitous alignment within the tunnel section could serve to disorient drivers at the tunnel exit.

Additional benefits realized with the Preferred Alternative are: peak hour LOS for mainline I-93 are improved over all three other designs; LOS for major intersections in the Project area are improved over Scheme Z and 8.1D Mod 5, and are equivalent to those resulting from the Reduced River-Tunnel Alternative; and the Preferred Alternative has the lowest expected annual accident-to-million VMT ratio due to its simplified design.

Based upon these distinctions, the Preferred Alternative represents the best resolution of traffic operations and safety issues.

Environmental And Aesthetic Impacts. The environmental and aesthetic impacts considered in the comparison of the four alternatives included visual impacts, aquatic impacts (including navigation), materials disposal, air quality, and construction period impacts. These impacts are evaluated in accordance with the goals and objectives established for the selection process.

Visual Impacts: The visual impacts of Scheme Z were one of the primary reasons leading to further analysis of additional design alternatives for the Charles River Crossing. Each of the three new alternatives achieved substantial reductions in adverse visual impacts from those associated with Scheme Z. MHD remains committed to pursuing the conceptual bridge design depicted in this FSEIS/R. Alternative 8.1D Mod 5, because of its extensive tunneling, has the least adverse visual impacts. The Reduced River-Tunnel and the Preferred Alternatives both have moderate visual impacts (see Table 4.42 of the 1993 DSEIS/R) and are similar in their visual impacts on both existing and planned parklands, and on nearby communities. The distinctive differences between these two alternatives are the number of bridge piers located within the water environment, and the marginal additional impacts of the second bridge of the Preferred Alternative. It is possible that future detailed design studies may require a tower design that is somewhat different than that shown throughout the FSEIS/R for the Preferred Alternative as well as the other alternatives. However, incorporation of such design details could be made without substantially altering the impacts of the Preferred Alternative.

Aquatic Impacts (Including Navigation): Each of the new design alternatives improves upon the permanent aquatic impacts of Scheme Z, which requires the construction of 19 piers in the Charles and Millers Rivers to support the overhead structures. Two of the three alternatives, 8.1D Mod 5 and the Reduced River-Tunnel, increase construction period impacts on the aquatic resources of the Charles River (Section 4.5.1(b) of the 1993 DSEIS/R). Both Scheme Z and the Preferred Alternative have minimal construction period impacts on the Charles River. All three new designs require some filling of the Millers River in order to achieve greater open space along the banks of the Charles River.

Material Disposal: Each of the new alternatives requires an increase in the amount of excavation and dredged material to be disposed of (see Section 5.3 of the 1993 DSEIS/R). Of the three new alternatives the Preferred Alternative has the least amount of additional materials disposal, and therefore the least environmental impacts from such disposal.

Air Quality: Scheme Z generates the greatest vehicle miles of travel, and consequently the highest regional areawide CO emission of the four alternatives analyzed. For local intersection or microscale analysis, the Preferred and the Reduced River-Tunnel Alternatives improve upon the Scheme Z impacts. Alternative 8.1D Mod 5 impacts are essentially the same as Scheme Z. The Preferred Alternative shows an improvement in air quality over Scheme Z.

Construction Period Disruption: The Preferred Alternative has the lowest impact to traffic operations and transit service during construction of the three alternatives to Scheme Z. There is no loss of roadway connections; minimal disruption to operations at Leverett Circle; and no impact on commuter rail service. Scheme Z shows comparable construction period impacts to those of the Preferred Alternative, both of which are less than the Reduced River-Tunnel Alternative. Alternative 8.1D Mod 5 has the highest adverse impact due to its extended construction duration and due to the construction of multiple tunnels in the Leverett Circle area.

Based on the assessment of the total benefit to be realized for environmental and aesthetic considerations, none of the three new design alternatives presents a clearly superior resolution. The Preferred Alternative does, however, achieve very substantial aesthetic improvements to Scheme Z, while avoiding temporary impacts associated with river tunneling. The Preferred Alternative's shorter construction period also minimizes impacts to the affected communities.

Cost Considerations. Consideration of additional factors reinforce the conclusions outlined above, and reflect a conscientious balance of total benefit and cost to the public. While the cost of the Charles River Crossing is not a factor in the identification of an environmentally preferable alternative, fiscal responsibility must be considered in choosing among alternatives, whose environmental impacts, as analyzed and documented in the environmental review process, prove to be substantially equivalent.

Cost and schedule elements may then be balanced with the other considerations discussed above. A review of these elements shows that the estimated cost for the construction and right-of-way purchase of the four alternatives ranges from $489 to $1,282 million for Scheme Z and 8.1D Mod 5, respectively. The estimated cost for the Reduced River-Tunnel Alternative is $1,131 million; while the estimated cost for the Preferred Alternative is $995 million. Duration of construction for the Preferred Alternative is 8.5 years, the same as that of Scheme Z. Alternative 8.1D Mod 5 requires 13 years, while the Reduced River-Tunnel Alternative requires 9 years.

Summary. In summary, the Preferred Alternative provides the greatest benefit with respect to the traffic operations, safety, and environmental objectives established by MHD, and satisfies the goals and objectives of the BDRC. In addition, the Preferred Alternative fully addresses the concerns expressed by FHWA and USACE regarding the design of Scheme Z and the river tunnel alternatives. Also, the review of the cost and schedule elements of the alternatives is not at variance with and, in fact, supports the identification of the Preferred Alternative. For these reasons, the Non-River-Tunnel Alternative with the described refinements was identified as the Preferred Alternative for evaluation in this FSEIS/R.

3. Affected Environment

Chapter 3
AFFECTED ENVIRONMENT

This chapter provides a concise description of the social, economic, and environmental setting in the Area North of Causeway Street, the Project subarea affected by the Charles River Crossing. Also described are proposed developments by others in this subarea. It updates information provided in the 1991 FSEIS/R and the 1993 DSEIS/R for the Charles River Crossing. The information presented here is little changed from that in the 1993 report.

The subarea is the northernmost of the I-93 portion of the Central Artery/Tunnel Project (see Figure 3.1). It is bounded on the south by Causeway Street, on the north by Cambridge Street between Sullivan Square in Charlestown and the Somerville/Charlestown border, on the west by Blossom Street at Storrow Drive, and on the east by the North Washington Street bridge, connecting Keany Square in Boston with City Square in Charlestown. The majority of the subarea is in the City of Boston including the Charlestown neighborhood (Suffolk County); smaller portions are in Cambridge and Somerville (Middlesex County).

Chapters 4 and 5 of this document discuss the long-term environmental consequences and the short-term, temporary construction period impacts of the Preferred Alternative and compares these impacts to those of Scheme Z. More specific information on the affected environment is described in those chapters to enable readers to compare impacts directly with existing conditions.

3.1 GENERAL DESCRIPTION OF SUBAREA

The Area North of Causeway Street has been developed over several decades as a major transportation and industrial corridor. The area has also attracted a variety of commercial and institutional uses, including the Boston Garden/North Station, Spaulding Rehabilitation Hospital, and the Suffolk County Jail. The Project subarea also includes areas designated as parkland but as yet undeveloped for park purposes, and one residential property near Lomasney Way. Residential areas are primarily located outside of the Project alignment in Charlestown, eastern Somerville, East Cambridge, the West End (Charles River Park and Longfellow Towers apartments), Beacon Hill, and the North End. Nonresidential development in the corridor ranges from dense to sparse, and the area continues to be the focus of intense redevelopment interests, particularly on underused parcels.

The Charles River bisects the area, flowing west to east and into Boston Harbor. It drains from the upper Charles River Basin through the lower basin located downstream between the old MDC dam at O'Brien Highway and the new Charles River Dam and locks located between the existing I-93 high-level bridge and the North Washington Street bridge (see Figure 3.2). The Millers River flows from the north into the Charles River via two subterranean culverts. Approximately 27,000 vessels (mostly pleasure boats) passed through the upper and lower Charles River dam and locks in 1992, with the highest use during the summer (8,000 vessels in July).

The competing recreation, navigation, and development interests and the opportunities presented by the planned transportation infrastructure improvements in this confined area have generated land use planning studies by the cities of Boston and Cambridge, as well as a parkland master planning study by the MDC, dated August 1993. Existing parkland is located at Paul Revere Landing Park North and South and is minimally developed (see Figure 3.3). Additional parkland is located at Leverett Circle/ Storrow Drive, a part of the Charles River Reservation, along Nashua Street, and at the former GSA parcel in North Point, to be developed for park use. Further information about land use characteristics is in Section 4.2 of this report.

3.1.1 Neighborhoods And Districts

The Area North of Causeway Street includes and abuts six distinct districts or neighborhoods. The Project alignment generally bisects the area in a north/south direction. South of the Charles River is the North Station area, flanked on the west by the West End, and on the east by the North End. North of the river are East Cambridge, Charlestown, and farther north, eastern Somerville. Brief descriptions of the primary areas in the vicinity of the Project and of any changes since the 1991 FSEIS/R and the 1993 DSEIS/R follow.

North Station. The North Station area also includes the immediate area south of Causeway Street. The rehabilitation of buildings in the Bulfinch Triangle for office space has increased, and a few new office buildings have been completed. The 60-year-old Boston Garden arena with seating for almost 15,000 persons sits atop North Station, which serves MBTA commuter trains to the northern suburbs. Behind the station are the platforms and 10 railroad tracks leading to the four-track bascule bridge across the Charles River. Across Causeway Street is another MBTA station serving the Orange Line rapid transit below grade and the Green Line light rail transit primarily above Causeway Street.

Other prominent features in the area include the O'Neill Federal Office Building, the Anelex Building (already acquired by MHD for future demolition), and the BTEC's Minot Station steam generating plant. Between North Station and the Charles River is the Spaulding Rehabilitation Hospital, a chronic care/rehabilitation facility. Across Nashua Street from the hospital is the historic Registry of Motor Vehicles building at 100 Nashua Street. Construction of the Suffolk County Jail and the realignment of Nashua Street are recently completed projects in this area.

Other changes since 1991 in the North Station area include the following: completion of 101 Merrimac Street, a new 155,000-sf office building; completion of 100 Portland Place, a rehabilitated office building with 100,000 sf; initiation by the MBTA of construction of a 1,300-space underground parking garage which includes a portion of the tunnel box for the future relocation of the Green Line; and initiation of construction by the New Boston Garden Corporation (NBGC) of a 19,500-seat sports arena above the new MBTA garage.

Across Nashua Street from the jail is a parcel of land which is designated as parkland, but currently serves as a helipad and parking area. Ownership of this parcel was transferred to the MDC as part of the Chapter 91 license for the jail.

West End. The primary uses are hospital, medical service, high-density housing (mainly Charles River Park apartments), and retail. Recent development in the area includes substantial additions to Massachusetts General Hospital. Undeveloped land is limited to the remaining urban renewal parcel next to Charles River Park (proposed for housing development). The MBTA Science Park Green Line station is located here, elevated above Leverett Circle. No other new construction has been initiated since the 1991 FSEIS/R in the area closest to the Project alignment.

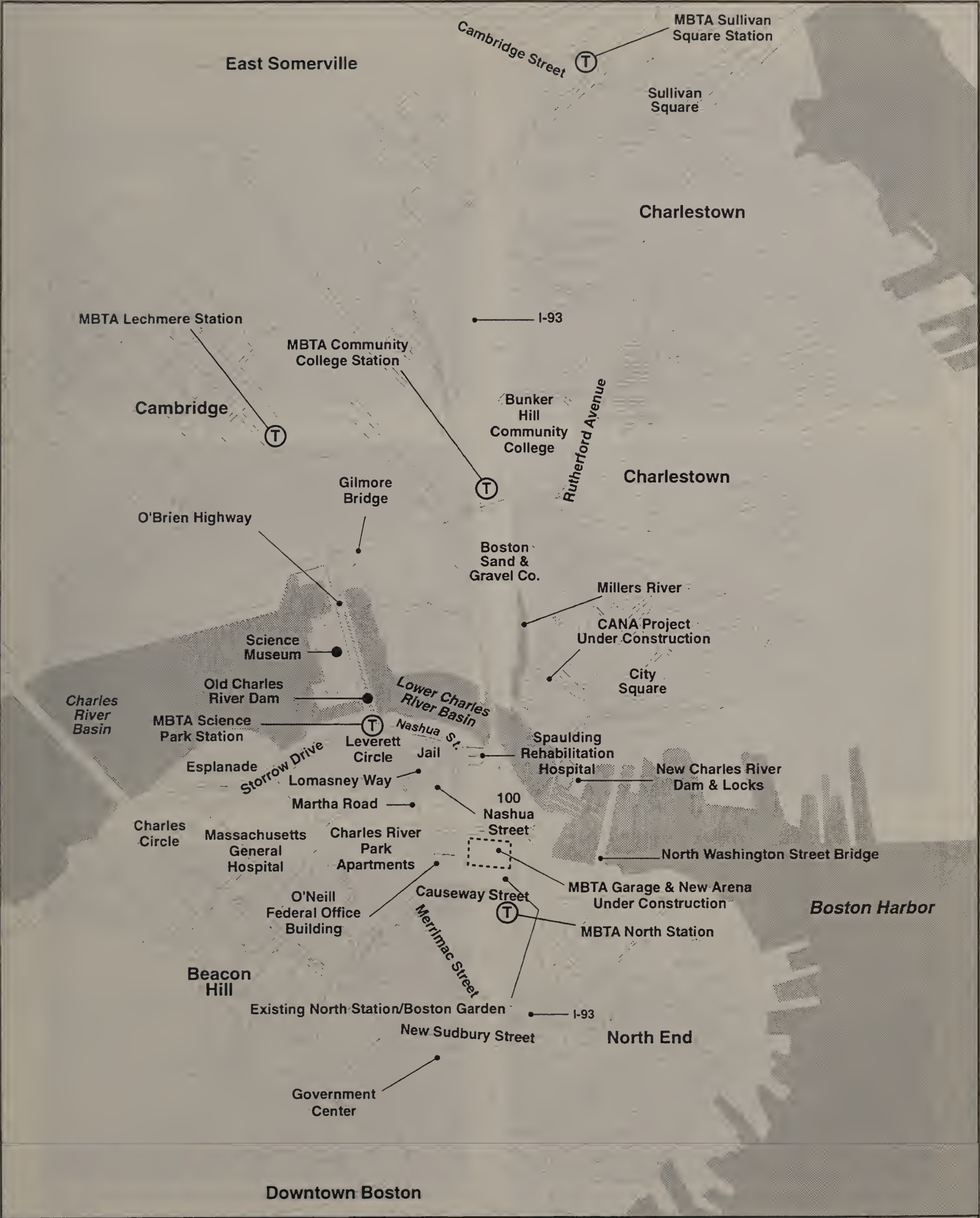
North End. Although the housing stock once consisted mainly of rental apartments, there are now many new and converted condominium units in the area. Some low-rise, high-rent office space has recently been developed on the south edge of the North End, an area that has become an extension of the waterfront's office/residential/retail orientation.

Housing demand has been strong, with the number of rental units declining as a result of many condominium conversions. This trend has slowed over the last 3 years due to economic conditions. No major new construction in the North End has been initiated near the Project limits since the 1991 FSEIS/R.

Charlestown. North of the Charles River, the Charlestown Navy Yard continues to be redeveloped for residential and commercial use, and is expected to encourage further development in the surrounding area.

The nearly completed CANA (highway) project is expected to stimulate new development on the parcels it has created near City Square and the rehabilitation of existing buildings in the area. Project components completed in 1993 include a new tunnel under City Square, providing access between Rutherford Avenue and the Tobin Bridge. The CANA EIS/R designated five development parcels in the City Square area. During the past few years, the neighborhood has experienced housing rehabilitation and condominium conversion. This trend has decreased recently due to economic conditions. No other new construction has been initiated in Charlestown near the Project area since the FSEIS/R.

Cambridge. The Museum of Science and its parking garage are located on filled land along the south side of the O'Brien Highway. The historic Street Railway Viaduct carries the Green Line along the east side of the O'Brien Highway. Farther east, the North Point area of East Cambridge is bounded by the Charles River on the south, O'Brien Highway on the west, the Gilmore Bridge to the north, and the Millers River and Charlestown to the northeast. The area comprises primarily industrial, public infrastructure, and transportation uses, including the MWRA Prison Point Pumping Station, railroad track and piggyback yards owned by Guilford Transportation


MBTA Sullivan Square Station
Cambridge Street
East Somerville
Sullivan Square
Charlestown
MBTA Lechmere Station
I-93
MBTA Community College Station
Cambridge
Bunker Hill Community College
Rutherford Avenue
Charlestown
Gilmore Bridge
O'Brien Highway
Boston Sand & Gravel Co.
Millers River
CANA Project Under Construction
Science Museum
City Square
Old Charles River Dam
Lower Charles River Basin
Charles River Basin
MBTA Science Park Station
Nashua St.
Leverett Circle
Jail
Spaulding Rehabilitation Hospital
Esplanade
Storrow Drive
Lomasney Way
New Charles River Dam & Locks
Martha Road
100 Nashua Street
Charles Circle
Massachusetts General Hospital
Charles River Park Apartments
North Washington Street Bridge
MBTA Garage & New Arena Under Construction
Causeway Street
O'Neill Federal Office Building
Boston Harbor
MBTA North Station
Merrimac Street
Beacon Hill
Existing North Station/Boston Garden
I-93
New Sudbury Street
North End
Government Center
Downtown Boston

FIGURE

3.1

Affected Environment
Existing Conditions

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

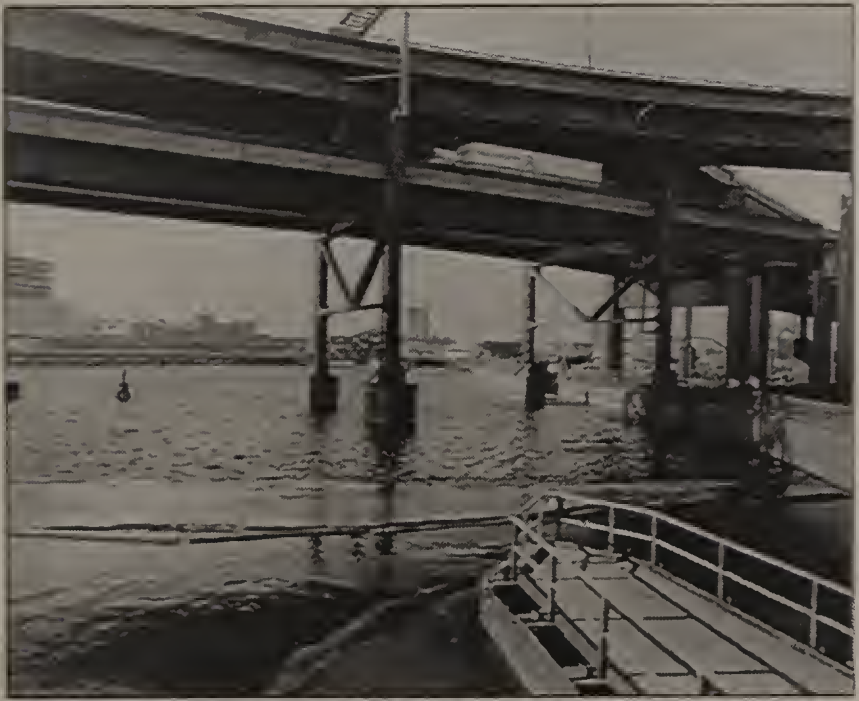
0 200 400 600 1200 FEET

Existing high-level bridge (I-93) from upstream.

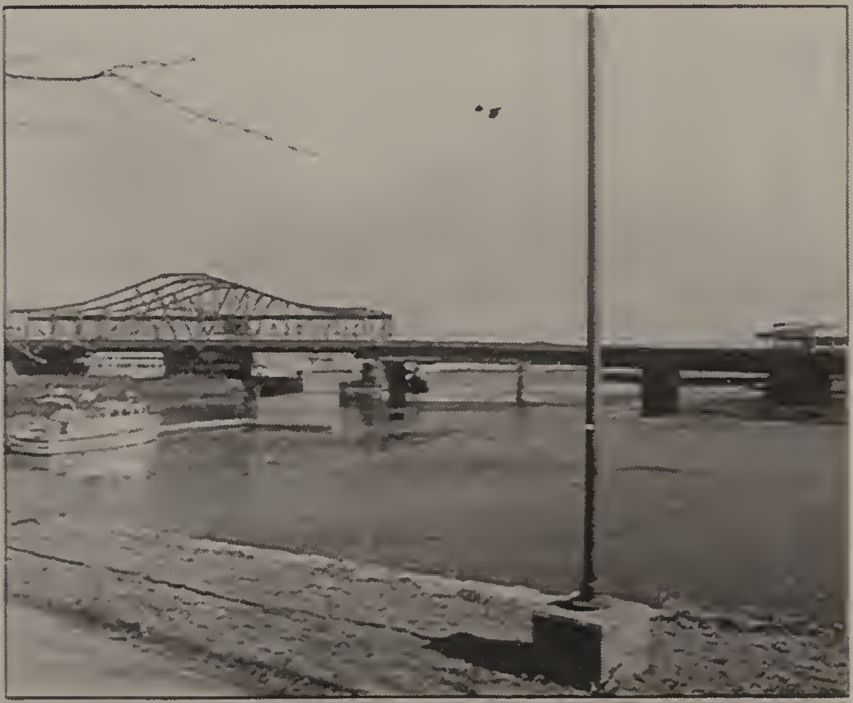
Existing high-level bridge (I-93) from upstream.

Navigation channel markers at Charles River dam locks.

Pedestrian walkway (left) over Charles River dam locks.



View of high-level double-decked bridge from Charles River dam walkway.



View downstream from south bank of Paul Revere Landing Park. Charlestown Bridge in background.

FIGURE

3.2

Views Of Lower Charles River

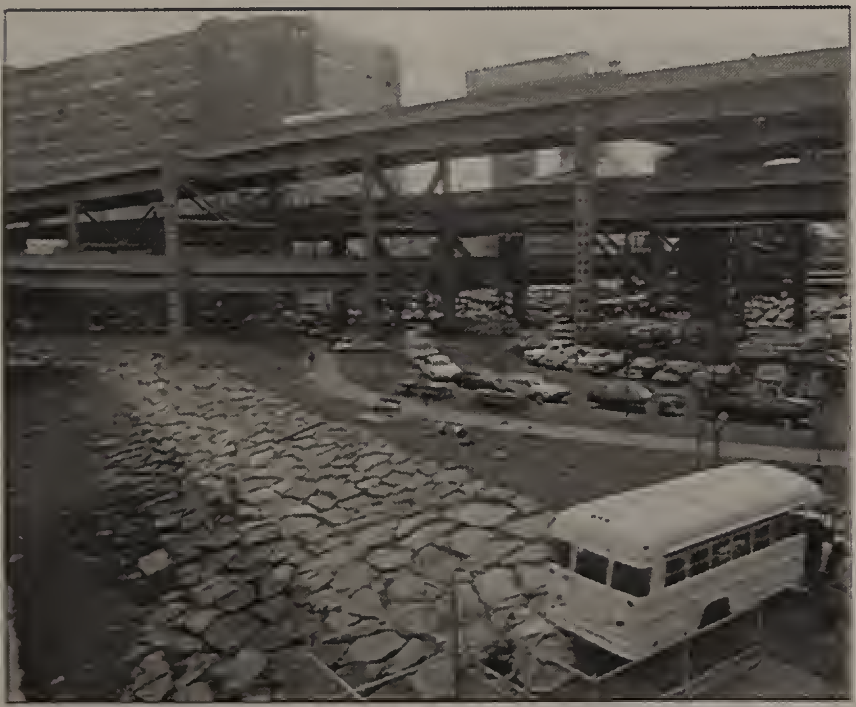
MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

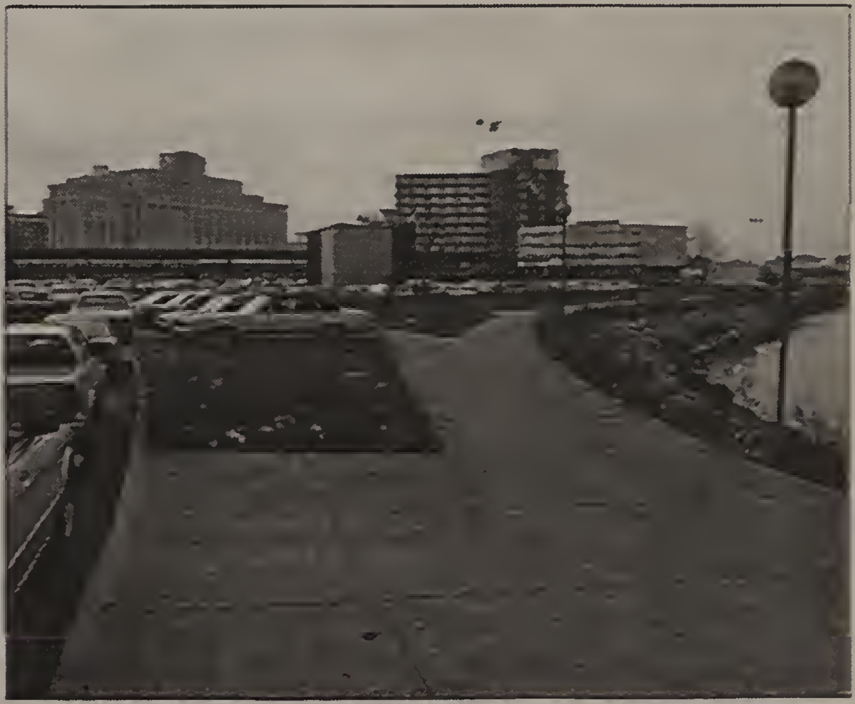
Entrance to park from public street under Central Artery.

Southeast edge of park.

Riverside walkway.

Park's eastern edge (right). Charles River dam and Harbor Police building in background.


Park consists primarily of parking spaces and riverside walkway on either side of Charles River dam.


Riverside walkway connecting with walkway on MBTA trestle (in distance).

FIGURE

3.3

Views Of Paul Revere Landing Park, South Bank Of River

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Industries, the MDC central services facility, an MHD storage area, and a solid waste transfer station. A parcel in this area, formerly owned by the GSA, has been transferred to the MDC for future development of park purposes. No new construction has been initiated adjacent to the Project alignment in Cambridge.

Somerville. The Boston and Maine Railroad yards north of the Gilmore Bridge and the eastern Somerville mixed use neighborhood abut the Project area's northwestern edge. No major new development has occurred there since 1990.

3.1.2 Existing Transportation Facilities

The major north-south interstate highway in the area is I-93. In addition, U.S. Route 1 connects with Storrow Drive via an existing high-level double-deck bridge structure that also carries I-93 mainline traffic across the Charles River. There are three complex at-grade interchanges that are critical to moving traffic through the area to local and regional destinations: Leverett Circle in the West End (see Figure 3.4), City Square in Charlestown, and the O'Brien Highway (old Charles River Dam)/ Gilmore Bridge intersection in Cambridge. In 1979, MHD initiated the CANA project, in Cambridge and Charlestown, in order to improve traffic safety conditions and regional traffic connections. Temporary ramps are scheduled for construction to connect the nearly completed CANA project to the existing Central Artery (I-93). These temporary ramps will be replaced in the future by a permanent connection to the Project's Preferred Alternative in the Area North of Causeway Street. Since these temporary ramps were designed to be compatible with alternative designs studied in the 1993 DSEIS/R for this subarea, they did not affect selection of the Preferred Alternative.

The existing highway system to be affected by the Project in the Charlestown portion of the subarea consists of a three- to four-lane-wide double-deck viaduct structure with the I-93 northbound lanes stacked over the I-93 southbound lanes. A portion of the existing viaduct from a point south of east Somerville/Sullivan Square to the Charles River will be removed and replaced with the new interchange system as part of the Project design.

The existing double-deck I-93 viaduct connects to a double-deck, high-level truss bridge, which crosses over the Charles River from Charlestown into downtown Boston. The bridge has three lanes in each direction. The existing bridge will be removed upon completion of the new bridges and connections of the Preferred Alternative.

At Causeway Street the existing bridge connects to the existing elevated Central Artery with three lanes in each direction. Existing northbound and southbound I-93 lanes connect to Charlestown and Route 1 via elevated ramps on the north bank of the Charles River and to Storrow Drive/Route 1 at Leverett Circle on viaduct behind North Station.

The MBTA operates commuter railroad service to the north and west of Boston through North Station. North of the river is a larger major railroad yard. In addition, the MBTA operates rapid transit service via the Orange Line, with three stations in the affected area, on surface at Sullivan Square and Community College and in subway at North Station. It also operates light rail transit service on the elevated Green Line with three stations at Lechmere (East Cambridge), Science Park (above Leverett Circle), and North Station. South of the study area, MBTA operates a bus terminal on surface above its Haymarket Orange Line/Green Line station. See Section 4.1, Transportation, for more details on transportation facilities in the area.

3.2 PROPOSED PROJECTS

The locations of the proposed projects in the Area North of Causeway Street are shown in Figure 3.5.

Public Projects. The City of Boston's goal for the North Station area, as stated in the Interim Policy Overlay District regulations, is to encourage mixed use development compatible with the adjacent Bulfinch Triangle and North End districts. Its economic development plan for the area north of North Station calls for major high-rise commercial development.

The MBTA plans to upgrade the present commuter railroad service at North Station by extending the 10 railroad tracks and high-level platforms 275 feet south toward the north facade of the existing Boston Garden, by constructing a new Orange Line/Green Line station below grade at North Station, and by replacing the Green Line now on viaduct in the area with a new below-grade alignment behind the Boston Garden and through the edge of the 1,300-space MBTA underground garage now under construction. Also included are foundation supports for future development of an air rights parking garage over the railroad tracks. Farther north, across the Charles River, a new and relocated MBTA Green Line Lechmere station is proposed to serve the East Cambridge area., In addition, the Science Park station will be reconstructed.

Separate ongoing studies by the Massachusetts EOTC and the Federal Transit Administration (FTA) are exploring the feasibility of linking North and South Stations to provide for through intercity and commuter railroad service in the future. Alternative alignments under consideration traverse the Area North of Causeway Street.

Proposed public open space improvements planned by the MDC in the area include the following: a park located between Nashua Street and the Charles River, a park on the Cambridge side of the river (on land acquired from the General Services Administration), and extensions on both riverbanks of bicycle and pedestrian paths from the Charles River Esplanade to Paul Revere Landing Park on riverside land currently owned by MHD and others. The goal of the MDC parkland master plan for the lower Charles River Basin is to develop continuous open space along the north and south banks of the Charles River between the Esplanade and Boston Harbor.

Private Projects. The Massachusetts General Hospital has development plans (primarily office and garage parking) for a parcel of land along the east side of Nashua Street between Spaulding Rehabilitation Hospital and North Station. The site is currently used for surface parking. The parcel is divided by two zoning districts which limit maximum height levels to 150 and 300 feet, respectively.

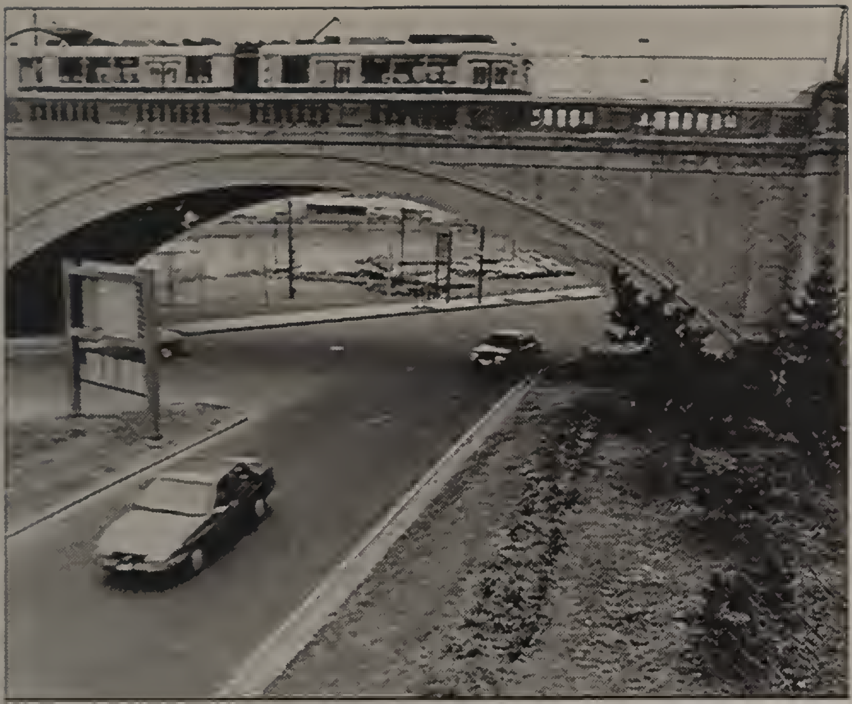
The NBGC announced plans in October 1990 to develop a sports arena and commercial complex with office and retail uses encompassing the site of the existing Boston Garden and adjacent areas north of Causeway Street. Construction began in spring 1993 on the 19,500-seat sports arena comprising 755,500 sf, in air rights above the new MBTA garage which began construction earlier. Completion is scheduled for 1995. Construction of office components has been deferred until the commercial market improves.

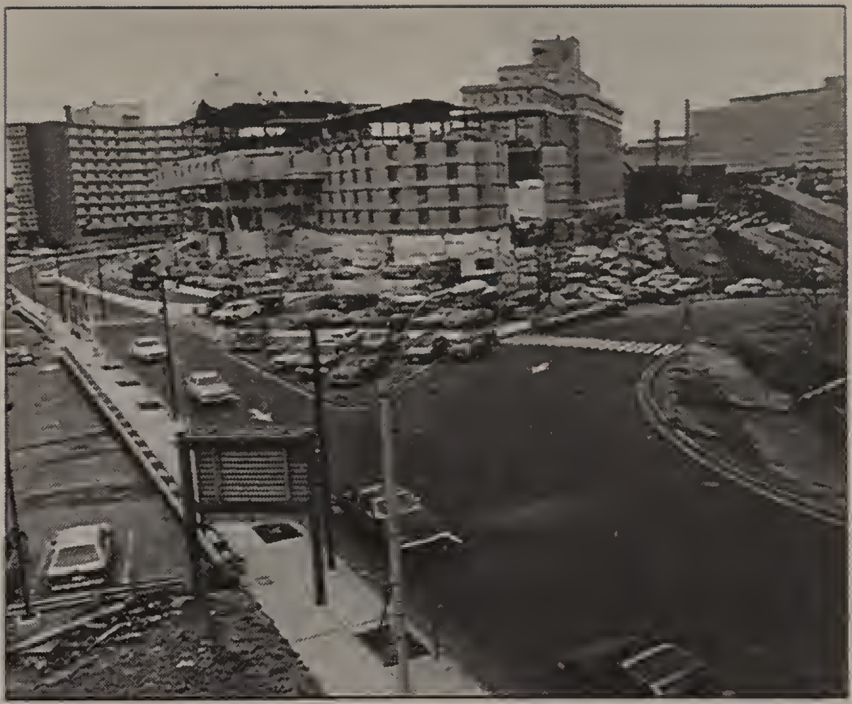
In April 1993, Lowell Square Associates announced plans to construct a housing project on the last parcel of the West End Urban Renewal Area adjacent to Charles River Park. The planned development includes 104 cooperative apartments, 85 elderly units, a West End Visitors Center, underground parking for 110 cars, and 5,000 square feet of commercial space at the corner of Staniford Street and Lomasney Way, south of and near the Project right-of-way. Construction had not begun as of January 1994.

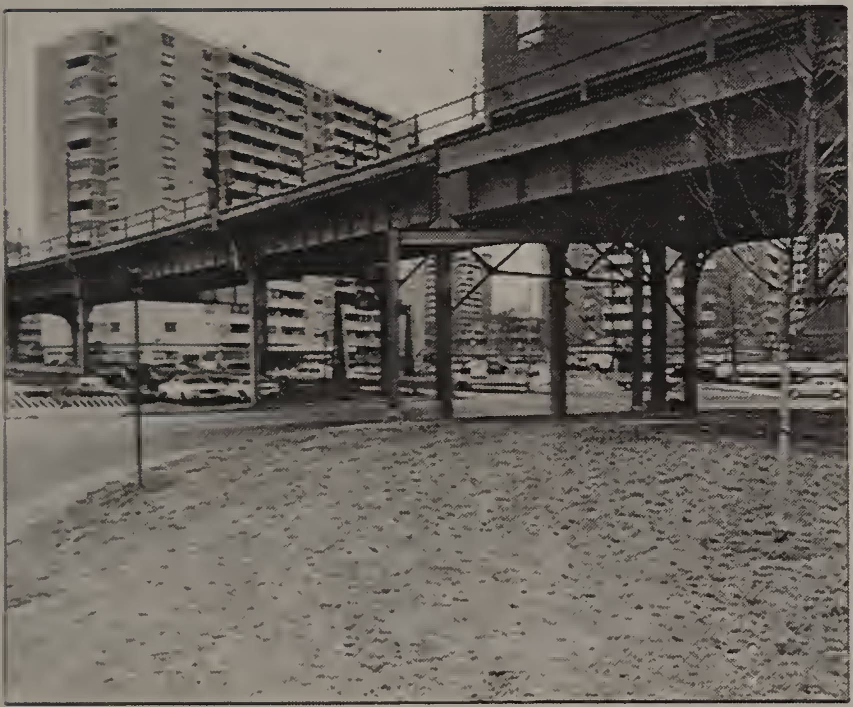
North Point in Cambridge, an area bounded by the north bank of the Charles River, the Gilmore Bridge, and commuter railroad tracks, is the site of a planned mixed use development district. According to the Cambridge Planning Board, it is a fully permitted private project in two phases. Phase I consists of 435 housing units and a 500-car garage; Phase II will add 202 housing units and a 120-car garage. New riverfront parkland planned by MDC would abut this private development. Construction had not begun as of January 1994.

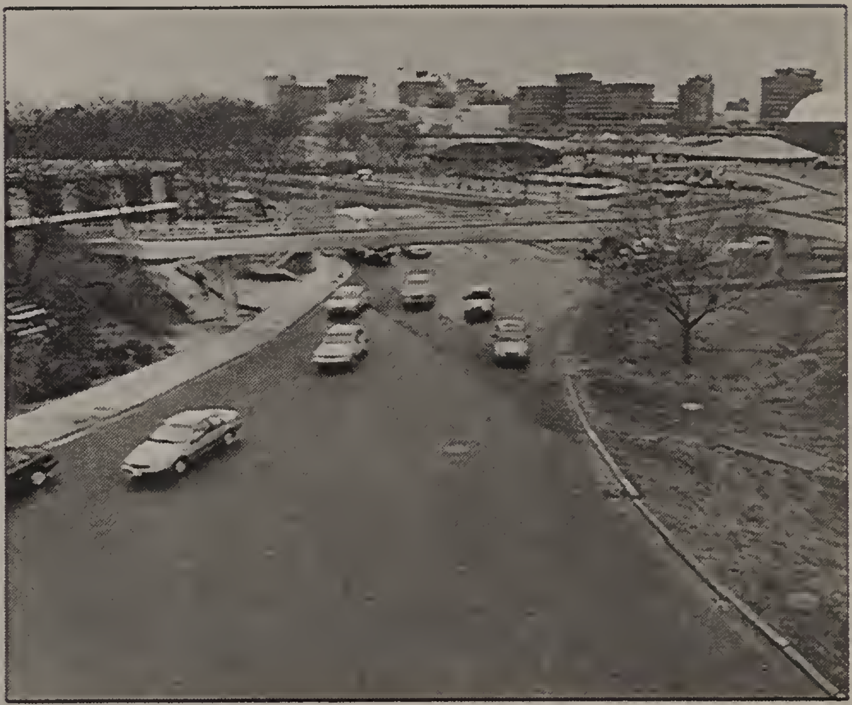
3.3 SUMMARY

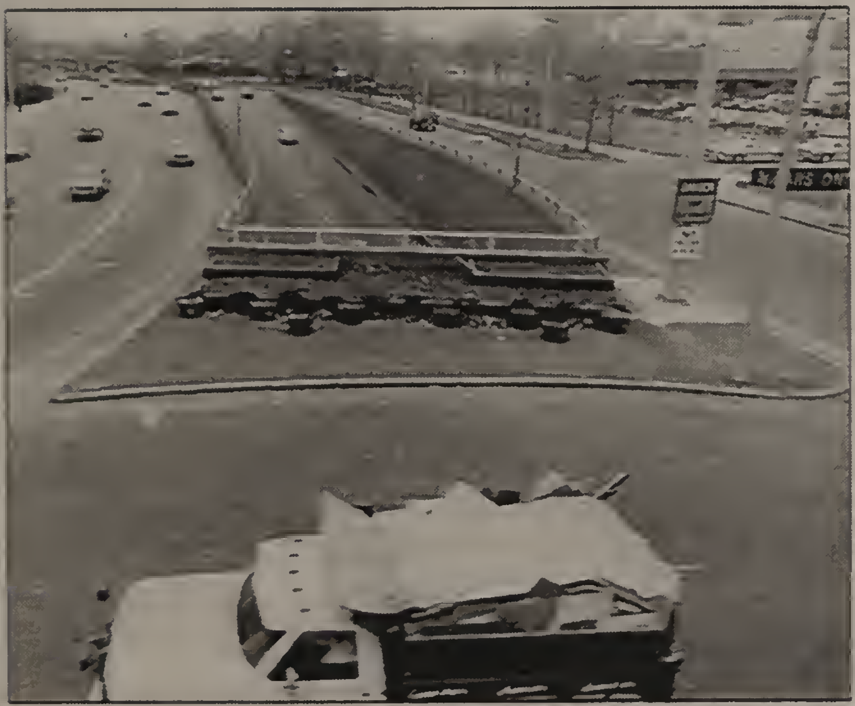
Generally, the existing and planned land use/development in the Area North of Causeway Street Project subarea has not changed since the 1991 FSEIS/R was published in November 1990. The most important changes are the initiation of previously planned and identified new construction on the MBTA parking garage and the new arena atop it behind North Station, and the near completion of the CANA project in Charlestown, a portion of which was opened in mid-1993.

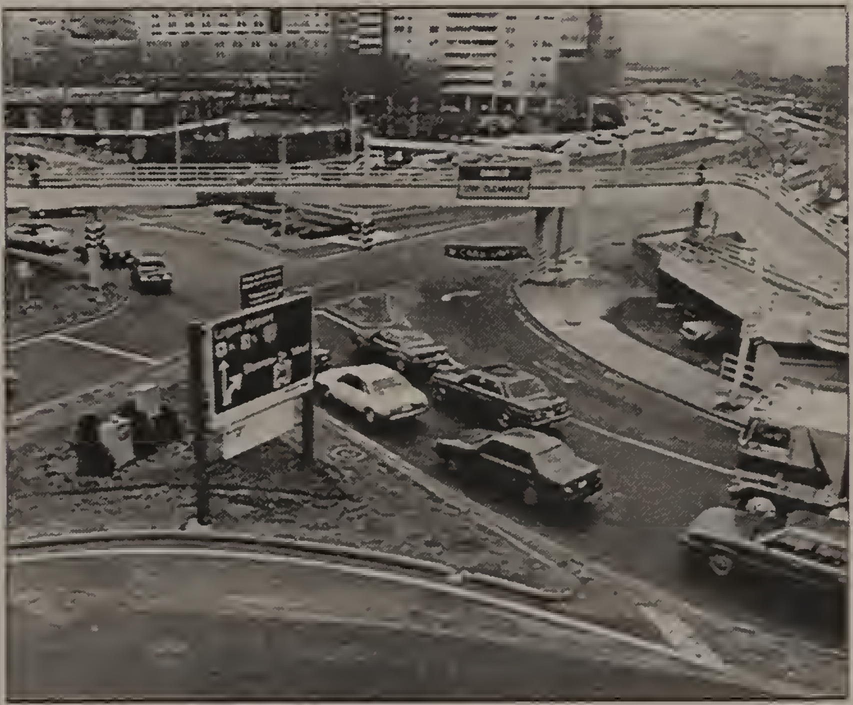

Green Line train on viaduct over Leverett Circle.


North edge of Leverett Circle rotary from MBTA elevated station. New jail under construction in background.


MBTA elevated tracks and rapid transit station above Leverett Circle.


South half of Leverett Circle looking west to Storrow Drive. Esplanade in background.


Existing westbound Storrow Drive underpass (center) and eastbound lanes (left) at Leverett Circle

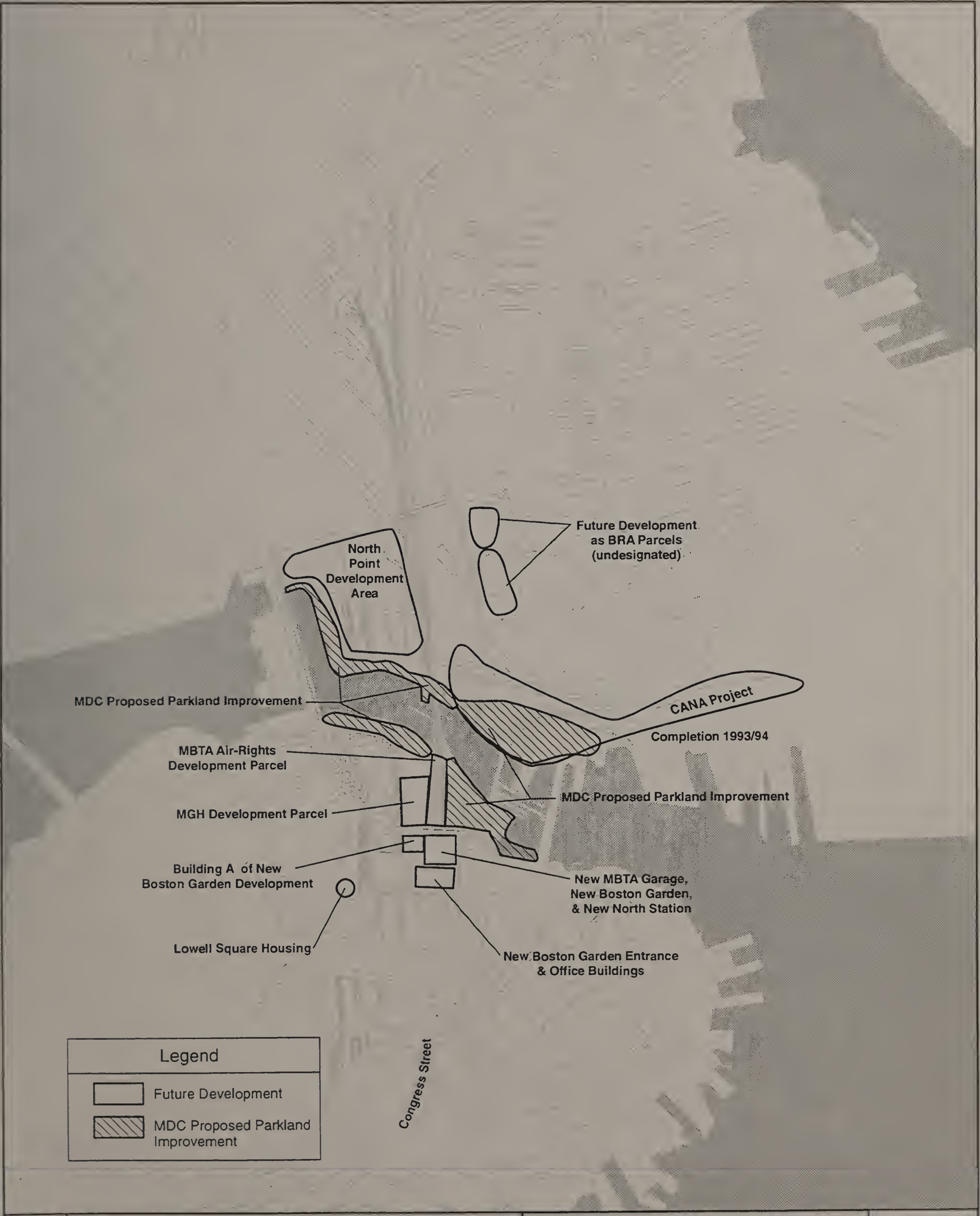

West edge of Leverett Circle (left), pedestrian overpass, Storrow Drive (right) and Charles River Park development in background.

FIGURE

3.4

Views Of Leverett Circle And Storrow Drive

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Future Development
as BRA Parcels
(undesignated)
North
Point
Development
Area
MDC Proposed Parkland Improvement
CANA Project
Completion 1993/94
MBTA Air-Rights
Development Parcel
MDC Proposed Parkland Improvement
MGH Development Parcel
Building A of New
Boston Garden Development
New MBTA Garage,
New Boston Garden,
& New North Station
Lowell Square Housing
New Boston Garden Entrance
& Office Buildings
Congress Street
Legend
▭ Future Development
▨ MDC Proposed Parkland Improvement

FIGURE

3.5 Affected Environment
Future Conditions

Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNELPROJECT

0 200 400 600 1200 FEET

4. Environmental Consequences

Chapter 4
ENVIRONMENTAL CONSEQUENCES

This chapter describes the long-term environmental consequences of the Preferred Alternative in comparison to Scheme Z, the 1991 Proposed Action in the Area North of Causeway Street. Subject categories included are the following: transportation, land use, air quality, noise and vibration, aquatic resources, threatened and endangered species, historic and archaeological preservation, hazardous waste sites, visual impacts, energy, the relationship of local short-term uses versus long-term productivity, and the irreversible and irretrievable commitment of resources. Temporary construction period impacts are detailed in Chapter 5.

4.1 TRANSPORTATION

4.1.1 Introduction

This section presents an analysis of transportation impacts of the Preferred Alternative compared with Scheme Z. The analysis compares traffic conditions on mainline highway segments and surface streets in terms of traffic volumes and operational characteristics, including speeds and level of service (LOS). Broader transportation system impacts also are documented, consisting of changes in HOV and public transportation facilities, parking supply characteristics, and pedestrian and bicycle circulation.

The concept of LOS is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists. Six levels of service are defined with letter designations from A through F, with LOS A representing the best operating conditions, and LOS F the worst. LOS A represents free flow (operating at the posted speed) on a highway section, or very low delay at a signalized intersection; LOS E represents conditions at or near capacity on a highway, or the limit of acceptable delay at an intersection; and LOS F represents a forced or breakdown traffic flow on a highway, or a delay at an intersection of greater than 60 seconds.

The analysis focuses on impacts in the design year 2010. Traffic and transportation characteristics of the affected environment are documented in the 1991 FSEIS/R. The base year, 1987, traffic volumes, operational characteristics, and roadway/intersection conditions were developed from extensive field data. These data are documented in the Transportation Technical Memorandum, 1990.

Study Area. The transportation study area for this Charles River Crossing FSEIS/R covers downtown Boston north of State Street, I-93 as far north as the Somerville boundary line, Charlestown, East Cambridge, and eastern Somerville (see Figure 4.1). The area covered by the Projectwide traffic modeling network has been expanded since the 1993 DSEIS/R to cover the central and western sections of Cambridge and Somerville and I-93 as far north as the Medford town line. This extends the distance covered on I-93 by about 1.5 miles. The modeling network was also expanded at the west end of the Central Artery/Tunnel Project area in the Kenmore Square area (see Figure 4.2 for the expanded network).

The purposes of modifying the modeling network since the 1993 DSEIS/R are to assist MHD in refining the design of the Preferred Alternative for the Charles River Crossing and to provide improved construction planning capability for the entire Central Artery/Tunnel Project, independent of this FSEIS/R. The FSEIS/R study area encompasses the roadway links and intersections of the arterial and major collector system within approximately 1 mile of the Charles River Crossing to the north, west, and east, and to North Dorchester to the south. Impacts of the Charles River Crossing diminish with distance, such that differences between the two designs at the farther reaches of the existing study area tend to be negligible. No changes in the relative differences between the two designs were found in the forecast results of the expanded network model.

Forecasting Methodology. The process used in forecasting year 2010 traffic conditions is essentially the same as that described in a technical support document for the 1991 FSEIS/R, *Detailed Technical Model Documentation*, February 1990. It incorporates the following forecasting elements, as specified in FHWA guidelines and following the standard practice of the transportation planning profession:

- Land Use: changes in land use that will affect travel patterns and volumes in future years

- Trip Generation: forecast numbers of trips per square foot of development, as appropriate

- Trip Distribution: allocation of trips generated between points of origin and destination

- Mode Choice: mode of travel (e.g., private automobile, public transportation) that will be used for travel between points of origin and destination (in terms of a proportion of total number of trips forecast for each origin/destination pair)

- Traffic Assignment: specific routes that will be used on highway and public transportation networks for each vehicle or transit person trip

Updates of the process used in developing traffic volume forecasts since the 1991 FSEIS/R are described in a technical support document to this FSEIS/R.

Impact Summary. The principal transportation impacts for both Charles River Crossing designs are summarized below and in Table 4.1.

Local Streets And Intersections: The Preferred Alternative has the positive impact of generally decreasing traffic volumes on the network, though not uniformly, as a result of two factors. The first factor is the elimination of the need for double crossings of the Charles River for several major traffic movements, as required with Scheme Z. By eliminating these double crossings, movement between the Central Artery and Storrow Drive via the ramps becomes more direct, which induces traffic to shift from surface streets. The second factor contributing to reduced traffic on local and arterial streets is the inclusion in the Preferred Alternative of a northbound on-ramp in the upper downtown area. As a result, traffic volumes are substantially lower with the Preferred Alternative than with Scheme Z at a number of major intersections, including Keany Square, City Square, and Sumner Tunnel/North Washington Street; traffic volumes increase with the Preferred Alternative, however, at Cross Street/New Sudbury Street and Congress Street/ New Sudbury Street.

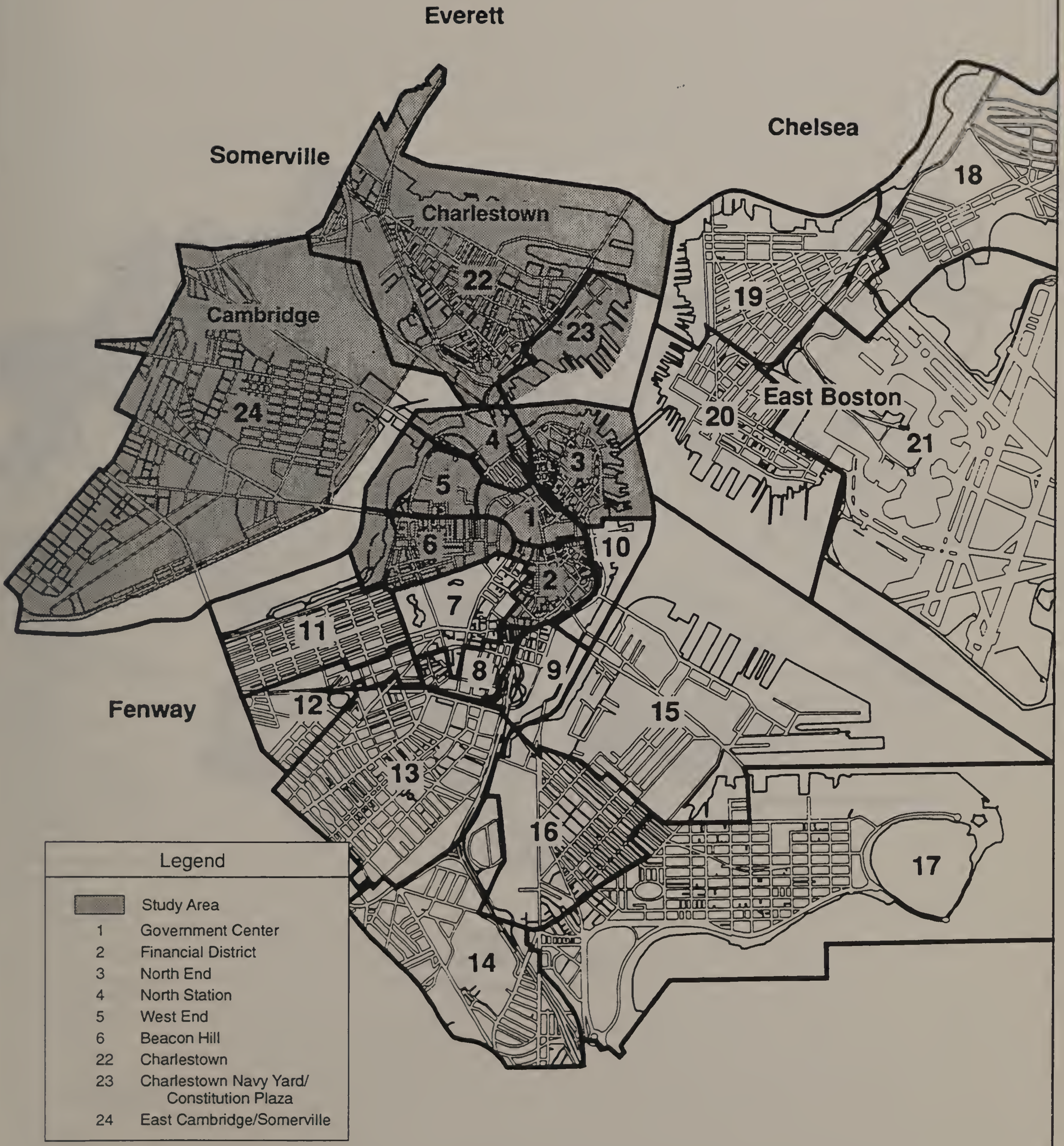
The Preferred Alternative results in a further reduction in traffic volume and improved operations in City Square, because the local Charlestown off-ramp is relocated to Cambridge Street southwest of Sullivan Square. This ramp is located in City Square with Scheme Z, causing City Square traffic operations to fail under that design.

The number of intersections operating at LOS F in the PM peak hour is about the same for both designs: nine with the Preferred Alternative, and 10 with the Scheme Z. In the AM peak hour, 14 intersections operate at LOS F with the Preferred Alternative, and 13 intersections operate at LOS F with Scheme Z.

I-93 Northbound: Northbound traffic operations on I-93 crossing the Charles River are better with the Preferred Alternative than with Scheme Z during the AM peak period, as a result of the increased capacity created by the viaduct structures incorporated into the new design. The I-93 on-ramp from Northern Avenue, however, creates a weave segment on I-93 northbound south of the Charles River that causes lower but still acceptable operating speeds. There is no discernible difference between alternatives in PM peak period northbound traffic operations.

I-93 Southbound: Traffic operations on the southbound mainline are similar for the Preferred Alternative and Scheme Z. On the segment of I-93 to the north of the Tobin Bridge on-ramp, operating speeds for general-purpose traffic are lower for the Preferred Alternative than for Scheme Z, due to reduced capacity and increased ramp traffic volume. The designation of a lane for exclusive HOV use causes the reduction in southbound general-purpose capacity, resulting in reduced operating speeds in general-purpose lanes. Modest increases in the use of the HOV lanes above forecast levels would substantially improve southbound general-purpose speeds and travel times for the Preferred Alternative. Traffic operations approaching the Storrow Drive on-ramp are somewhat worse for the Preferred Alternative than for Scheme Z.

HOV Operations: The Preferred Alternative incorporates a southbound HOV lane on the I-93 mainline, which is not included in Scheme Z. The HOV treatment included in Scheme Z is a lane on the Nashua Street off-ramp, which could be designated only with pavement striping. The advantage for HOVs relative to general-purpose traffic is greater with the Preferred Alternative. The two designs are compatible with a contraflow HOV lane concept, such as has been proposed for I-93 to the north of the Project limits.

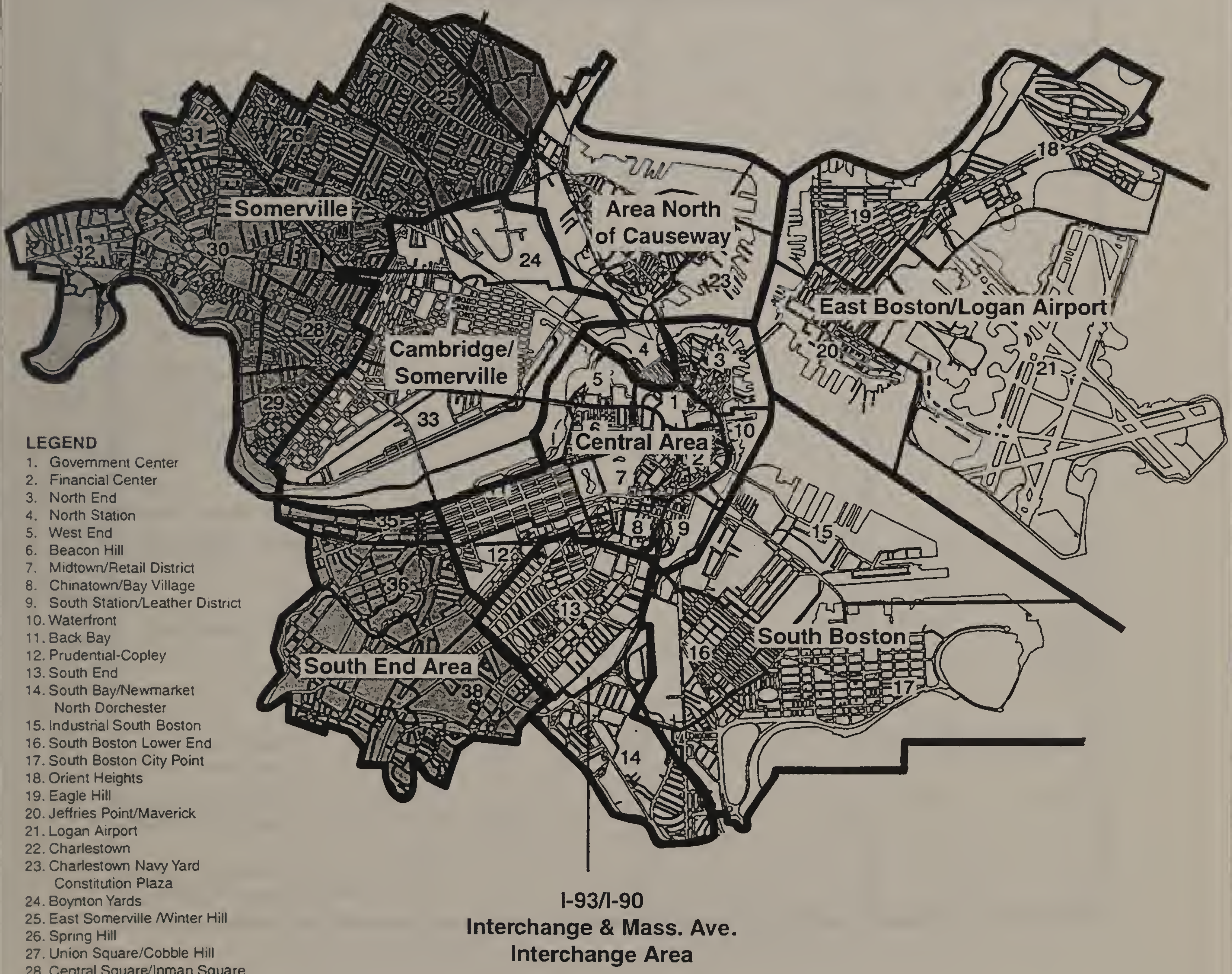

Everett
Somerville
Chelsea
Charlestown
Cambridge
East Boston
Fenway
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Legend
▨ Study Area
1 Government Center
2 Financial District
3 North End
4 North Station
5 West End
6 Beacon Hill
22 Charlestown
23 Charlestown Navy Yard/ Constitution Plaza
24 East Cambridge/Somerville

FIGURE

4.1 Transportation Study Area

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Somerville
Area North of Causeway
East Boston/Logan Airport
Cambridge/Somerville
Central Area
South Boston
South End Area
I-93/I-90 Interchange & Mass. Ave. Interchange Area
1
2
3
4
5
6
7
8
9
10
12
13
14
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16
17
18
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24
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33
35
36
38

LEGEND

1. Government Center
2. Financial Center
3. North End
4. North Station
5. West End
6. Beacon Hill
7. Midtown/Retail District
8. Chinatown/Bay Village
9. South Station/Leather District
10. Waterfront
11. Back Bay
12. Prudential-Copley
13. South End
14. South Bay/Newmarket North Dorchester
15. Industrial South Boston
16. South Boston Lower End
17. South Boston City Point
18. Orient Heights
19. Eagle Hill
20. Jeffries Point/Maverick
21. Logan Airport
22. Charlestown
23. Charlestown Navy Yard Constitution Plaza
24. Boynton Yards
25. East Somerville /Winter Hill
26. Spring Hill
27. Union Square/Cobble Hill
28. Central Square/Inman Square
29. West Cambridgeport
30. Harvard Square
31. Porter Square
32. West Cambridge
33. M.I.T.
34. East Cambridge/Lechmere
35. Boston University/Kenmore
36. Fenway
37. Longwood
38. Lower Roxbury

☐ Expanded Study Area

NOTE: The former network area DSEIS/R filed 1993 comprised districts 1-24, 33 & 34

FIGURE

4.2 Expanded Traffic Modeling Network

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Table 4.1

SUMMARY COMPARISON OF MAJOR OPERATING STATISTICS - YEAR 2010

	AM Peak		PM Peak		Daily	
Major Operating Statistic	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
Travel Time (minutes)						
Northbound-	3.57	3.50	5.05	5.57	n/a	n/a
*Southbound-	5.68	6.91	3.49	3.49	n/a	n/a
Eastbound-	3.54	3.16	7.15	7.85	n/a	n/a
Westbound-	3.97	7.40	4.01	5.06	n/a	n/a
Average Travel Speed (mph)						
Northbound-	35	37	25	23	n/a	n/a
*Southbound-	22	18	36	36	n/a	n/a
Eastbound-	30	31	17	15	n/a	n/a
Westbound-	29	15	28	22	n/a	n/a
Volumes Across Charles River						
Northbound: I-93/Storrow Dr.	8,020	7,828	11,609	12,628	146,397	151,841
Local bridges	4,406	4,667	5,673	5,185	84,994	80,640
Total NB	12,426	12,495	17,282	17,813	231,391	232,481
Southbound: I-93/Strorrow Dr.	12,559	11,935	9,928	9,609	145,885	139,533
Local bridges	5,965	6,506	5,674	5,807	87,368	87,007
Total SB	18,524	18,441	15,602	15,416	233,253	226,540
Daily Vehicle Miles of Travel, ANOC Area (VMT)	n/a	n/a	n/a	n/a	2,036,126	2,020,658
Daily Vehicle Hours of Travel, ANOC Area (VHT)	n/a	n/a	n/a	n/a	117,011	118,100
Number of Intersections Operating at Level of Service F	13	14	10	9	n/a	n/a

Northbound = Mainline NB from Essex/Northern On-Ramp to Sullivan Square
Southbound = Mainline SB from Sullivan Square to Sudbury On-Ramp
Eastbound = Storrow Drive EB From Blossom Street to Tobin Bridge at End of CANA Tunnel
Westbound = Tobin Bridge WB from Start of CANA Tunnel to Storrow Drive at Blossom Street

**Note:* *With the Preferred Alternative, traffic operations in southbound general-purpose lanes reflect commitment to allocating a lane for exclusive HOV use, which is forecast to be substantially below capacity, resulting in increased traffic volumes and reduced speeds in general-purpose lanes. Increased HOV use will improve general-purpose speeds.*

The Preferred Alternative provides superior bus access to I-93 northbound compared to Scheme Z. Access from a potential bus terminal in the area south of Causeway Street or Haymarket is via the New Sudbury Street on-ramp with the Preferred Alternative. With Scheme Z, bus access to I-93 northbound is substantially more circuitous, via Leverett Circle in Boston or via Assembly Square, which is north of the Project limits.

Hazardous Cargo: Existing primary hazardous cargo routes within the Project limits are not affected by the Preferred Alternative.

Vehicle Miles Travelled/Vehicle Hours Travelled: The Preferred Alternative reduces Projectwide VMT by 0.6 percent and VHT by 0.9 percent compared to Scheme Z, as described in Section 4.1.3.

4.1.2 Impacts

4.1.2(a) Traffic Volumes

In the year 2010, the Preferred Alternative results in a general though not uniform shift in traffic volumes (see Figures 4.3 and 4.4) to the expressway northbound system and away from local and arterial streets, as compared to Scheme Z (see Figures 4.5 and 4.6). This positive impact on surface street traffic conditions is due to elimination of the double river crossings required for several major traffic movements with Scheme Z. Differences in traffic patterns associated with the Preferred Alternative and Scheme Z are described in this section for the I-93 mainline, Storrow Drive, connectors between Storrow Drive, I-93 and the Tobin Bridge, and surface streets within the study area for this FSEIS/R, in terms of average weekday daily traffic (AWDT) in the design year 2010 (see Figures 4.7 through 4.9).

I-93 Mainline Traffic Volumes. Variations in daily traffic volumes on the I-93 mainline between the Preferred Alternative and Scheme Z are due to a number of factors. With Scheme Z, circuitous double crossings of the Charles River are required for traffic movements from I-93 northbound to Storrow Drive and from Storrow Drive to I-93 southbound. Portions of these movements occur on the I-93 mainline, increasing total traffic volumes. The Preferred Alternative carries lower mainline traffic volumes as a result of eliminating the double crossings. For this reason, it is possible to reduce the width of the bridge over the Charles River from five southbound mainline lanes under Scheme Z to four southbound mainline lanes with the Preferred Alternative.

Additional variations in mainline traffic volumes are related to differences in ramp configuration, with the proportion of vehicles carried on ramps, connectors, and mainline highway segments differing between the Preferred Alternative and Scheme Z (AWDT on mainline highway segments is shown in Tables 1 and 2 of Appendix A, Transportation).

Total Mainline And Local/Arterial Volumes. Total AWDT in the year 2010 for both Charles River Crossing designs, including mainline highway sections and connectors to the Tobin Bridge and Storrow Drive, are as follows:

Design	Number Of Vehicles
Preferred Alternative	291,374
Scheme Z	292,282

The above forecasts do not include the excess travel caused by the circuitous double river crossings required with Scheme Z. The AWDT volume forecast for the Preferred Alternative represents a decrease of 0.3 percent compared to Scheme Z, exclusive of the double crossings. The above figures represent the results of a screenline analysis used to compare the impacts on traffic patterns associated with each of the design alternatives under study. Imaginary screenlines are used to define a cordon across parallel roadways. Total traffic volume and volume shifts among the parallel roadways crossing the screenlines are compared for the alternative designs.

The positive effects of the Preferred Alternative result primarily from the diversion of vehicles away from the local street system, in response to the elimination of the double crossings required with Scheme Z, and the addition of a northbound on-ramp in the upper downtown area. This represents a positive impact to local streets. This shift in traffic patterns is reflected in the reduced AWDT forecast for the local bridge crossings of the Charles River. Traffic volumes are lower on each of the local bridge crossings (North Washington Street, Charles River Dam [i.e., O'Brien Highway], Longfellow Bridge, and Harvard Bridge) with the Preferred Alternative, as compared to Scheme Z. Collectively, the local bridges would carry 5 percent fewer vehicles per day northbound under the Preferred Alternative.

Considering both expressway and local roadway traffic volumes combined, the Preferred Alternative results in a slight reduction (less than 1 percent) in weekday traffic volumes in both directions over Scheme Z, not counting the impact of eliminating the double river crossings of Scheme Z. Accounting for the double crossing, the Preferred Alternative reduces the daily crossing volume by approximately 67,000 vehicles as travel between the Central Artery and Storrow Drive does not entail crossing the Charles River.

Storrow Drive/Charles Circle Traffic Volumes. The following locations are discussed because of major differences between the Preferred Alternative and Scheme Z.

Storrow Drive: Eastbound AWDT traffic volumes on Storrow Drive to I-93 southbound are somewhat less in the Preferred Alternative as compared to Scheme Z because Scheme Z provides an additional underpass movement. In the westbound direction from Leverett Circle, the Preferred Alternative carries slightly more traffic than Scheme Z, indicating a reduction in local street volumes.

To the west of Leverett Circle, Storrow Drive eastbound carries higher traffic volumes from points in the Back Bay with Scheme Z than with the Preferred Alternative (see Appendix A, Transportation). As a consequence, diversions to Charles Circle and other local roadways are higher. Westbound Storrow Drive AWDT to the west of Leverett Circle is less for the Preferred Alternative than for Scheme Z.

Charles Circle: Traffic volumes entering Charles Circle from eastbound Storrow Drive are highest under the Preferred Alternative, reflecting the diversion of traffic away from the Leverett Circle intersection to other surface streets (see Appendix A, Transportation). This shift in traffic to local streets is an adverse impact. Because the Preferred Alternative requires some eastbound movements to travel through Leverett Circle at grade, effective capacity is decreased and diversions to Charles Circle are increased by a few thousand vehicles on a daily basis, compared to Scheme Z.

Intersection Volumes. AWDT at intersections within the study area has been compared for both designs. The total volume of traffic entering individual intersections throughout the day serves as an indicator of changes in circulation patterns, numbers of vehicles on local and arterial roadways, and intersection demand levels. AWDT has been forecast for 38 intersections in the study area for the Charles River Crossing. These intersections, shown in Figure 4.7, have been selected because of their potential sensitivity to changes in the design of the crossing, in terms of traffic flow and air quality. Data for individual intersections are shown in Appendix A, and AM and PM peak hour intersection operations are presented in Tables 4.2 and 4.3.

Traffic volumes do not vary substantially among the designs at most of the intersections analyzed. Several changes in circulation patterns, however, cause traffic volume changes at a few intersections. These impacts are as follows:

- Daily intersection volumes are up to 7 percent lower for the Preferred Alternative than for Scheme Z at downtown intersections in the vicinity of the North Washington Street bridge, due to the inclusion of a northbound on-ramp in the upper downtown area (i.e., at New Sudbury Street in the Preferred Alternative). The intersections include Keany Square, Causeway Street and Surface Artery (northbound and southbound), and Sumner Tunnel and Cross Street.

- Traffic volumes forecast for the Preferred Alternative are 22 percent lower at City Square, and 7 to 20 percent lower at major intersections along Rutherford Avenue as compared to Scheme Z. This results from two factors. The first is the inclusion, in the Preferred Alternative, of the I-93 northbound on-ramp at New Sudbury Street; the second is the relocation of the I-93 local off-ramp from City Square to Cambridge Street near Sullivan Square.

- Differences between the Preferred Alternative and Scheme Z traffic volumes are minor at all intersections in Cambridge except Gilmore Bridge/O'Brien Highway where the Preferred Alternative is 26 percent higher than in Scheme Z. Intersections at New Chardon and Cambridge Streets and at Lomasney Way and Nashua Street have traffic volumes 5 percent lower with Scheme Z. This results because fewer vehicles travel through these locations on an alternate northbound route towards Cambridge with the inclusion of a northbound on-ramp in the Government Center area with the Preferred Alternative.

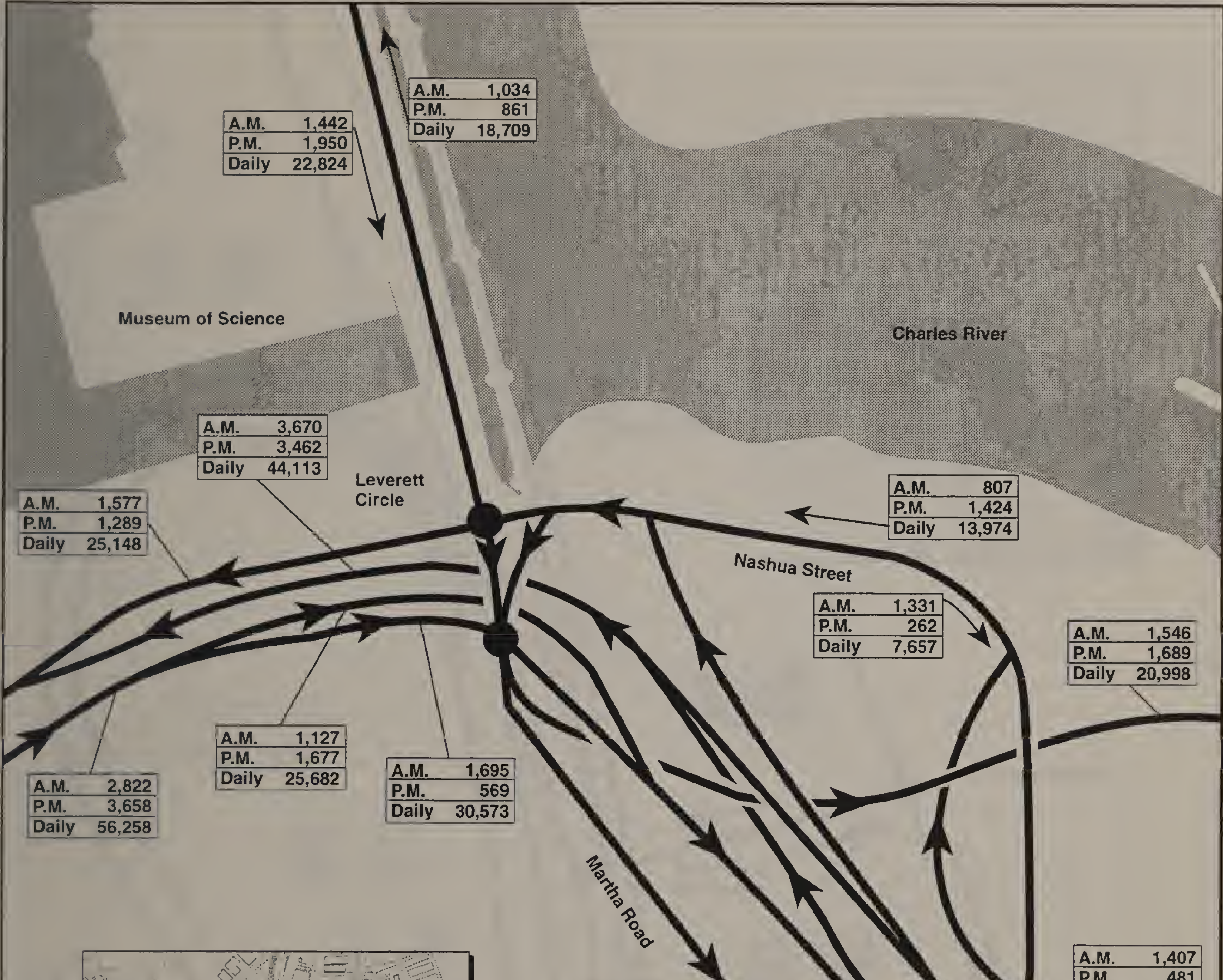

A.M. 1,034
P.M. 861
Daily 18,709
A.M. 1,442
P.M. 1,950
Daily 22,824
Museum of Science
Charles River
A.M. 3,670
P.M. 3,462
Daily 44,113
Leverett Circle
A.M. 1,577
P.M. 1,289
Daily 25,148
A.M. 807
P.M. 1,424
Daily 13,974
Nashua Street
A.M. 1,331
P.M. 262
Daily 7,657
A.M. 1,546
P.M. 1,689
Daily 20,998
A.M. 1,127
P.M. 1,677
Daily 25,682
A.M. 1,695
P.M. 569
Daily 30,573
A.M. 2,822
P.M. 3,658
Daily 56,258
Martha Road
A.M. 1,407
P.M. 481
Daily 13,044
A.M. 980
P.M. 730
Daily 11,213
Nashua/Lomasney On-Ramp
A.M. 1,492
P.M. 3,539
Daily 41,149
A.M. 1,747
P.M. 1,891
Daily 24,247
A.M. 1,524
P.M. 958
Daily 17,122

FIGURE
4.3

Peak Hour Traffic Volume
Leverett Circle Year 2010:
Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale

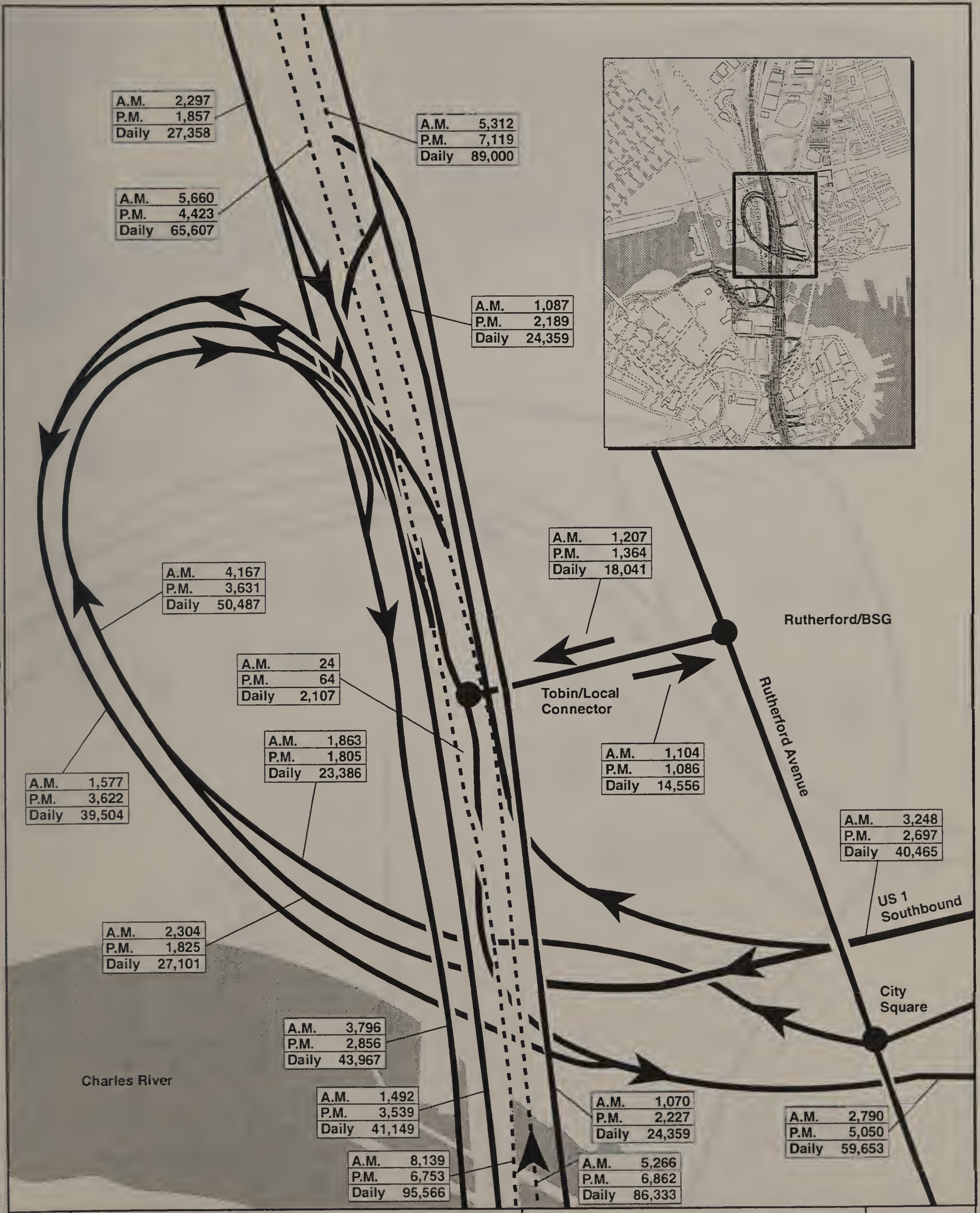

A.M. 2,297 P.M. 1,857 Daily 27,358
A.M. 5,312 P.M. 7,119 Daily 89,000
A.M. 5,660 P.M. 4,423 Daily 65,607
A.M. 1,087 P.M. 2,189 Daily 24,359
A.M. 1,207 P.M. 1,364 Daily 18,041
Rutherford/BSG
A.M. 4,167 P.M. 3,631 Daily 50,487
A.M. 24 P.M. 64 Daily 2,107
Tobin/Local Connector
Rutherford Avenue
A.M. 1,863 P.M. 1,805 Daily 23,386
A.M. 1,104 P.M. 1,086 Daily 14,556
A.M. 1,577 P.M. 3,622 Daily 39,504
A.M. 3,248 P.M. 2,697 Daily 40,465
US 1 Southbound
A.M. 2,304 P.M. 1,825 Daily 27,101
City Square
A.M. 3,796 P.M. 2,856 Daily 43,967
Charles River
A.M. 1,492 P.M. 3,539 Daily 41,149
A.M. 1,070 P.M. 2,227 Daily 24,359
A.M. 2,790 P.M. 5,050 Daily 59,653
A.M. 8,139 P.M. 6,753 Daily 95,566
A.M. 5,266 P.M. 6,862 Daily 86,333

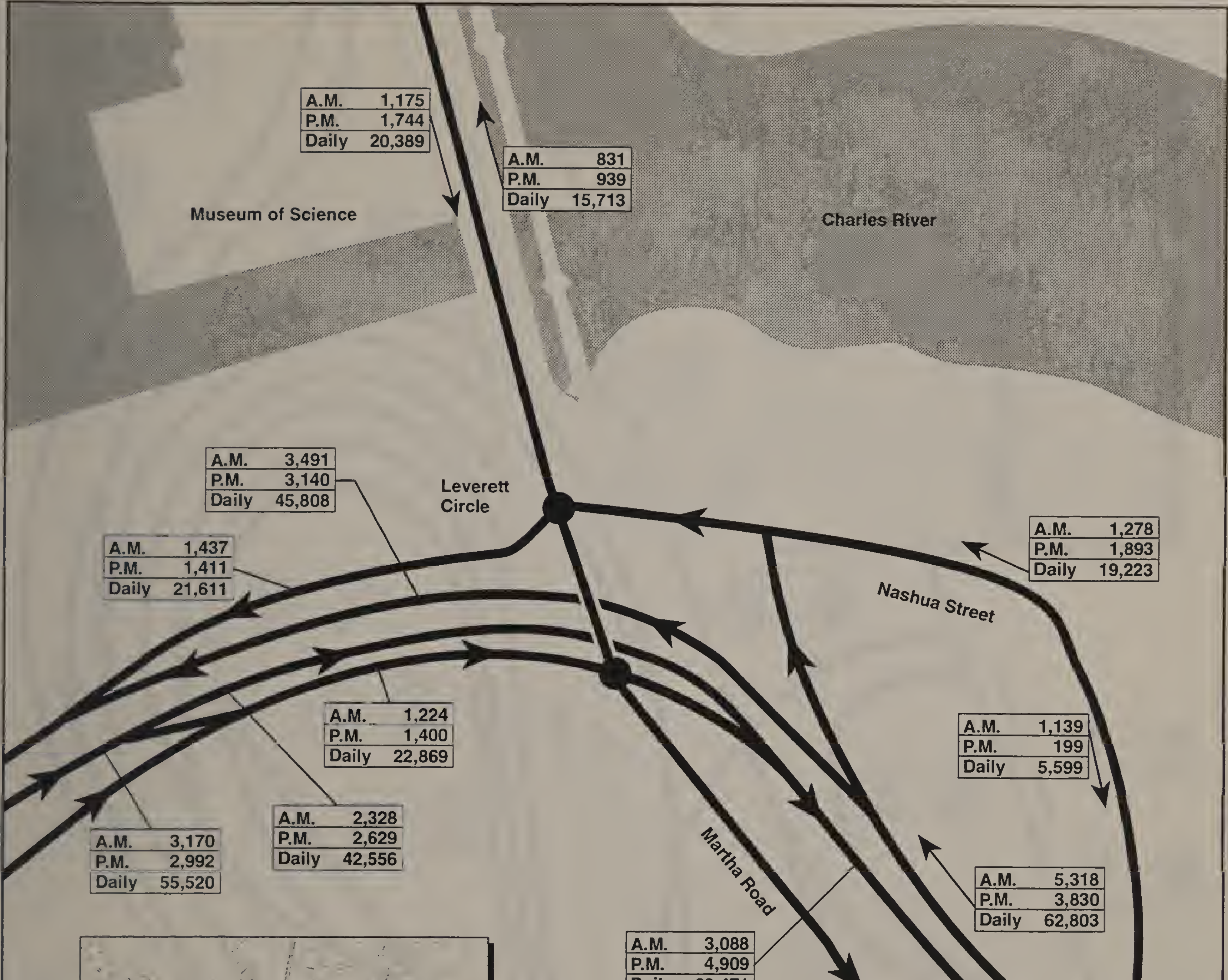
FIGURE
4.4

Peak Hour Traffic Volume Charlestown Year 2010: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale


A.M. 1,175
P.M. 1,744
Daily 20,389
A.M. 831
P.M. 939
Daily 15,713
Museum of Science
Charles River
A.M. 3,491
P.M. 3,140
Daily 45,808
Leverett Circle
A.M. 1,437
P.M. 1,411
Daily 21,611
A.M. 1,278
P.M. 1,893
Daily 19,223
Nashua Street
A.M. 1,224
P.M. 1,400
Daily 22,869
A.M. 1,139
P.M. 199
Daily 5,599
A.M. 3,170
P.M. 2,992
Daily 55,520
A.M. 2,328
P.M. 2,629
Daily 42,556
Martha Road
A.M. 5,318
P.M. 3,830
Daily 62,803
A.M. 3,088
P.M. 4,909
Daily 63,471
A.M. 1,025
P.M. 744
Daily 12,105
A.M. 1,539
P.M. 1,670
Daily 21,160
A.M. 1,757
P.M. 1,201
Daily 19,608

FIGURE

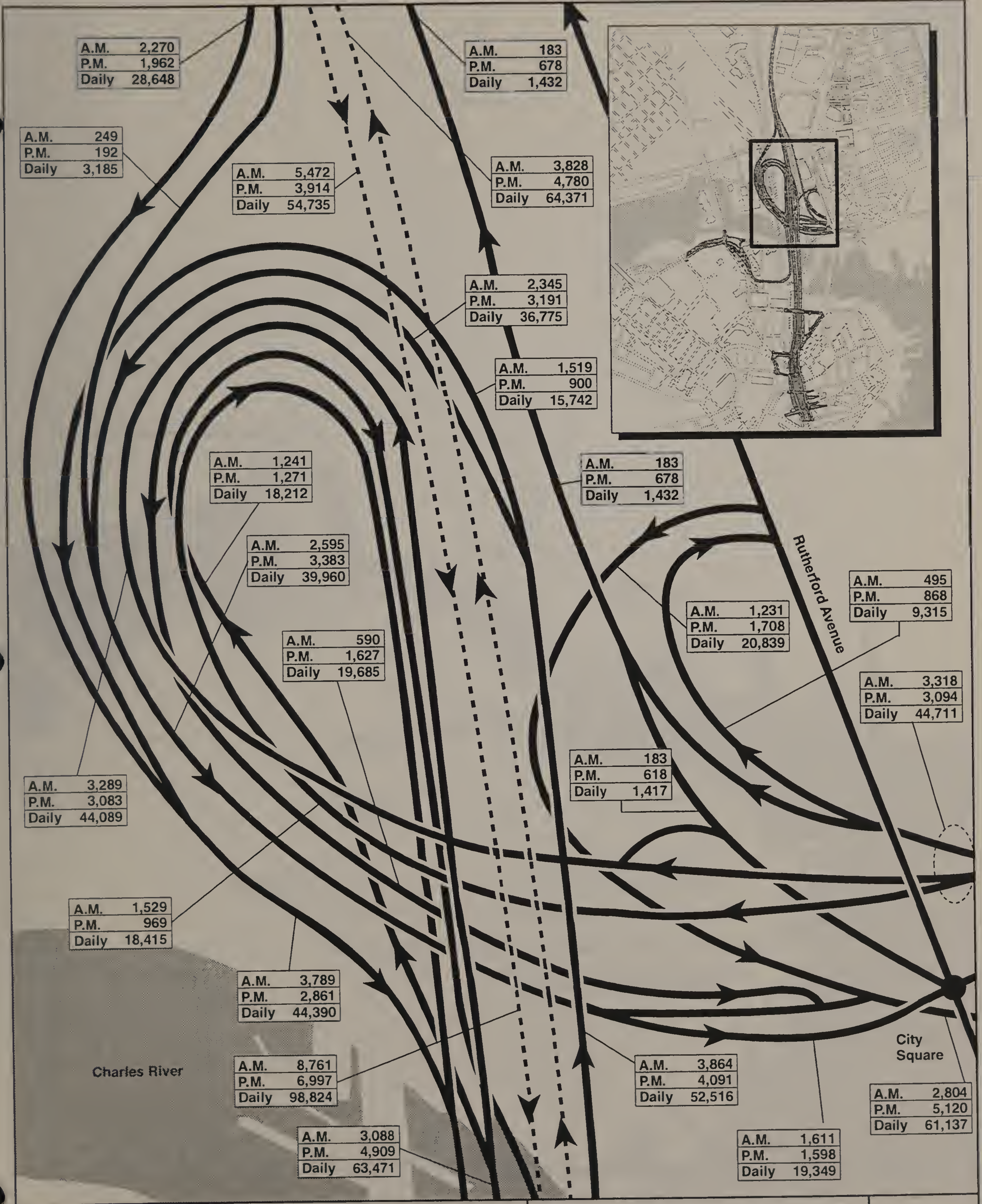
4.5

Peak Hour Traffic Volume Leverett Circle Year 2010: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale


A.M. 2,270 P.M. 1,962 Daily 28,648
A.M. 183 P.M. 678 Daily 1,432
A.M. 249 P.M. 192 Daily 3,185
A.M. 5,472 P.M. 3,914 Daily 54,735
A.M. 3,828 P.M. 4,780 Daily 64,371
A.M. 2,345 P.M. 3,191 Daily 36,775
A.M. 1,519 P.M. 900 Daily 15,742
A.M. 1,241 P.M. 1,271 Daily 18,212
A.M. 183 P.M. 678 Daily 1,432
A.M. 2,595 P.M. 3,383 Daily 39,960
Rutherford Avenue
A.M. 1,231 P.M. 1,708 Daily 20,839
A.M. 495 P.M. 868 Daily 9,315
A.M. 590 P.M. 1,627 Daily 19,685
A.M. 3,318 P.M. 3,094 Daily 44,711
A.M. 3,289 P.M. 3,083 Daily 44,089
A.M. 183 P.M. 618 Daily 1,417
A.M. 1,529 P.M. 969 Daily 18,415
A.M. 3,789 P.M. 2,861 Daily 44,390
Charles River
A.M. 8,761 P.M. 6,997 Daily 98,824
A.M. 3,864 P.M. 4,091 Daily 52,516
City Square
A.M. 2,804 P.M. 5,120 Daily 61,137
A.M. 3,088 P.M. 4,909 Daily 63,471
A.M. 1,611 P.M. 1,598 Daily 19,349

FIGURE

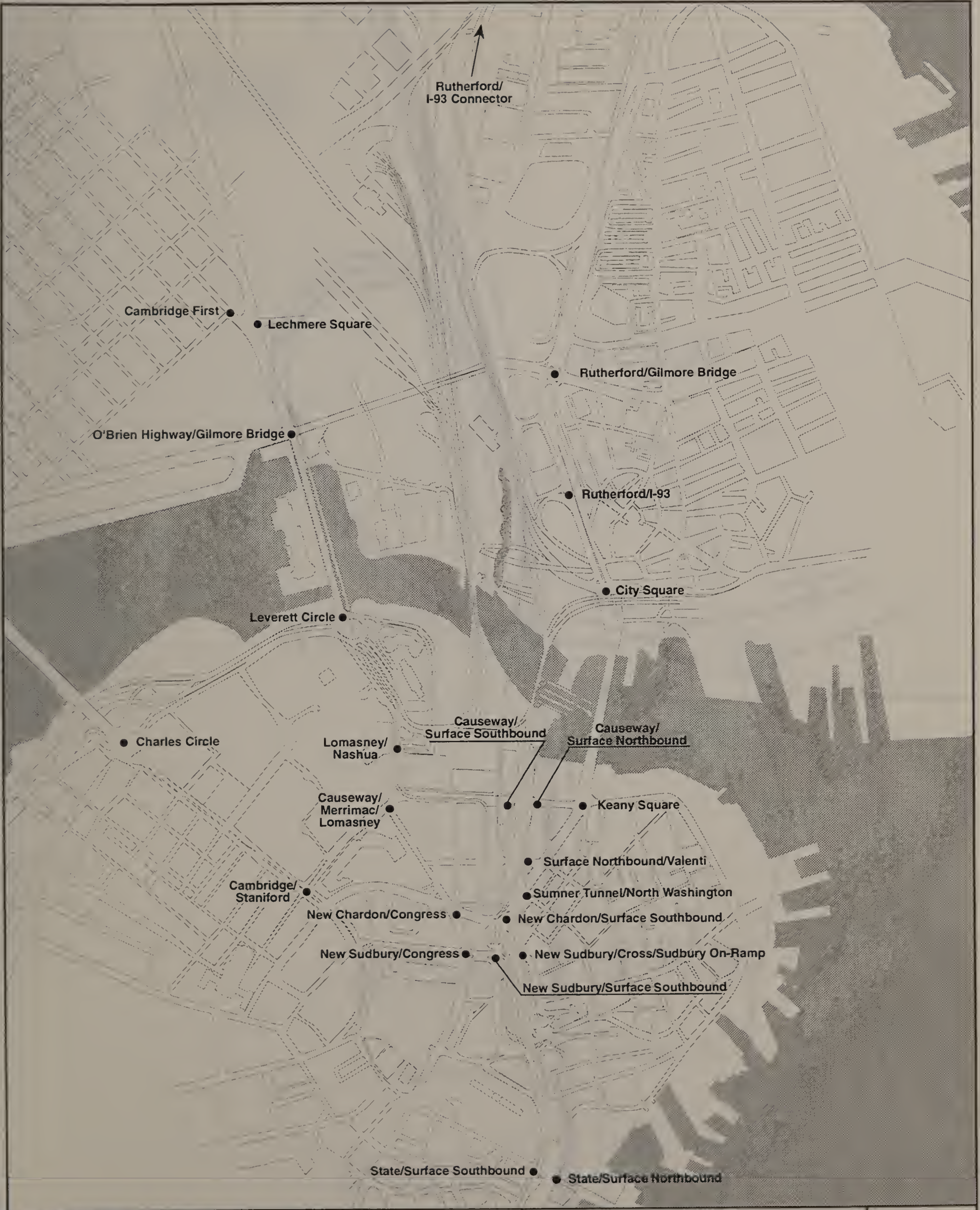
4.6

Peak Hour Traffic Volume
Charlestown Year 2010:
Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale


Rutherford/
I-93 Connector
Cambridge First
Lechmere Square
Rutherford/Gilmore Bridge
O'Brien Highway/Gilmore Bridge
Rutherford/I-93
City Square
Leverett Circle
Charles Circle
Lomasney/
Nashua
Causeway/
Surface Southbound
Causeway/
Surface Northbound
Causeway/
Merrimac/
Lomasney
Keany Square
Surface Northbound/Valenti
Cambridge/
Staniford
Sumner Tunnel/North Washington
New Chardon/Congress
New Chardon/Surface Southbound
New Sudbury/Congress
New Sudbury/Cross/Sudbury On-Ramp
New Sudbury/Surface Southbound
State/Surface Southbound
State/Surface Northbound
0 200 400 600 800 1000 FEET

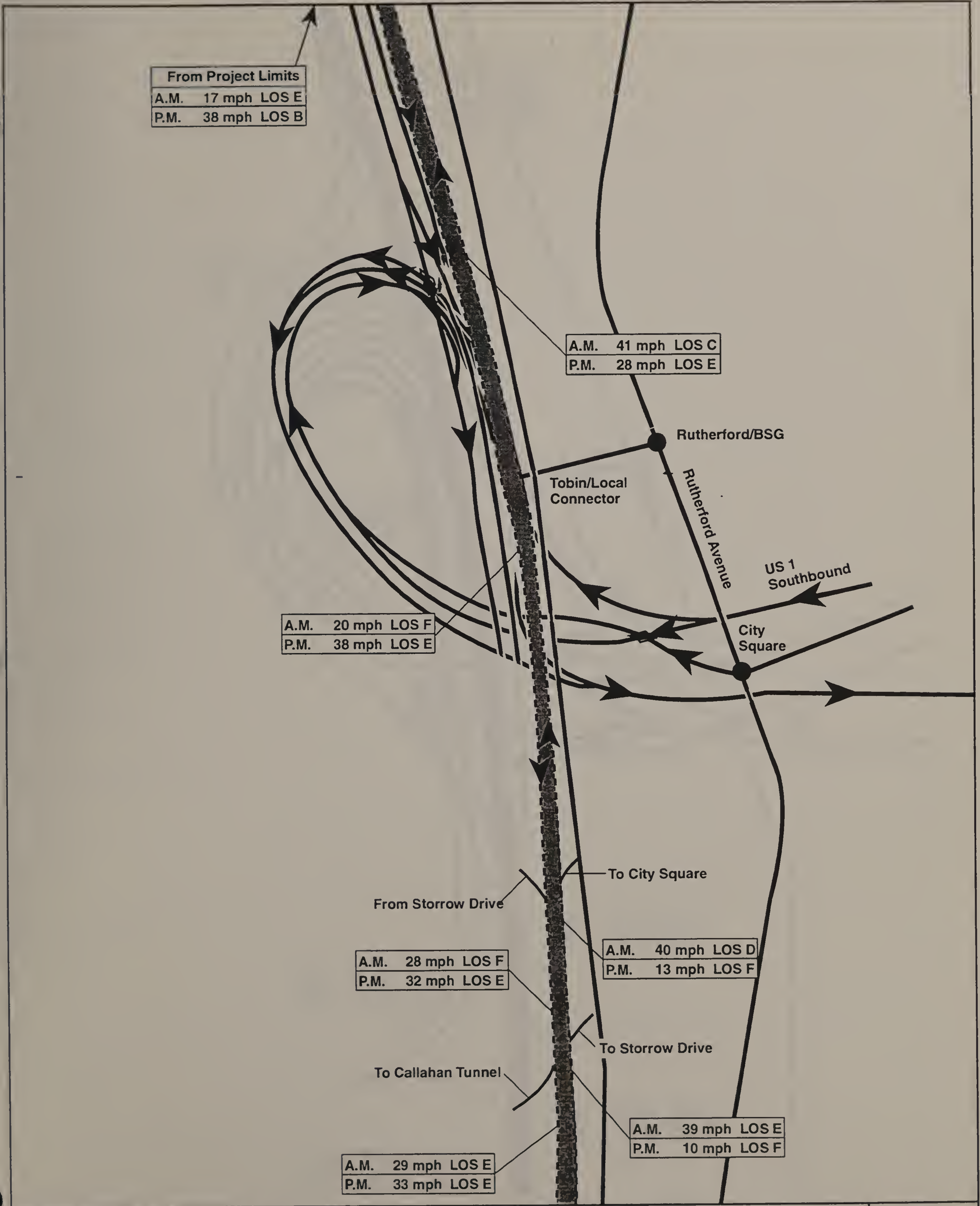
FIGURE

4.7

Intersection Analysis Locations
Existing Conditions

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


From Project Limits
A.M. 17 mph LOS E
P.M. 38 mph LOS B
A.M. 41 mph LOS C
P.M. 28 mph LOS E
Rutherford/BSG
Tobin/Local Connector
Rutherford Avenue
US 1 Southbound
City Square
A.M. 20 mph LOS F
P.M. 38 mph LOS E
To City Square
From Storrow Drive
A.M. 40 mph LOS D
P.M. 13 mph LOS F
A.M. 28 mph LOS F
P.M. 32 mph LOS E
To Storrow Drive
To Callahan Tunnel
A.M. 39 mph LOS E
P.M. 10 mph LOS F
A.M. 29 mph LOS E
P.M. 33 mph LOS E

FIGURE

4.8

I-93 Operating Speeds And Level Of Service: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale

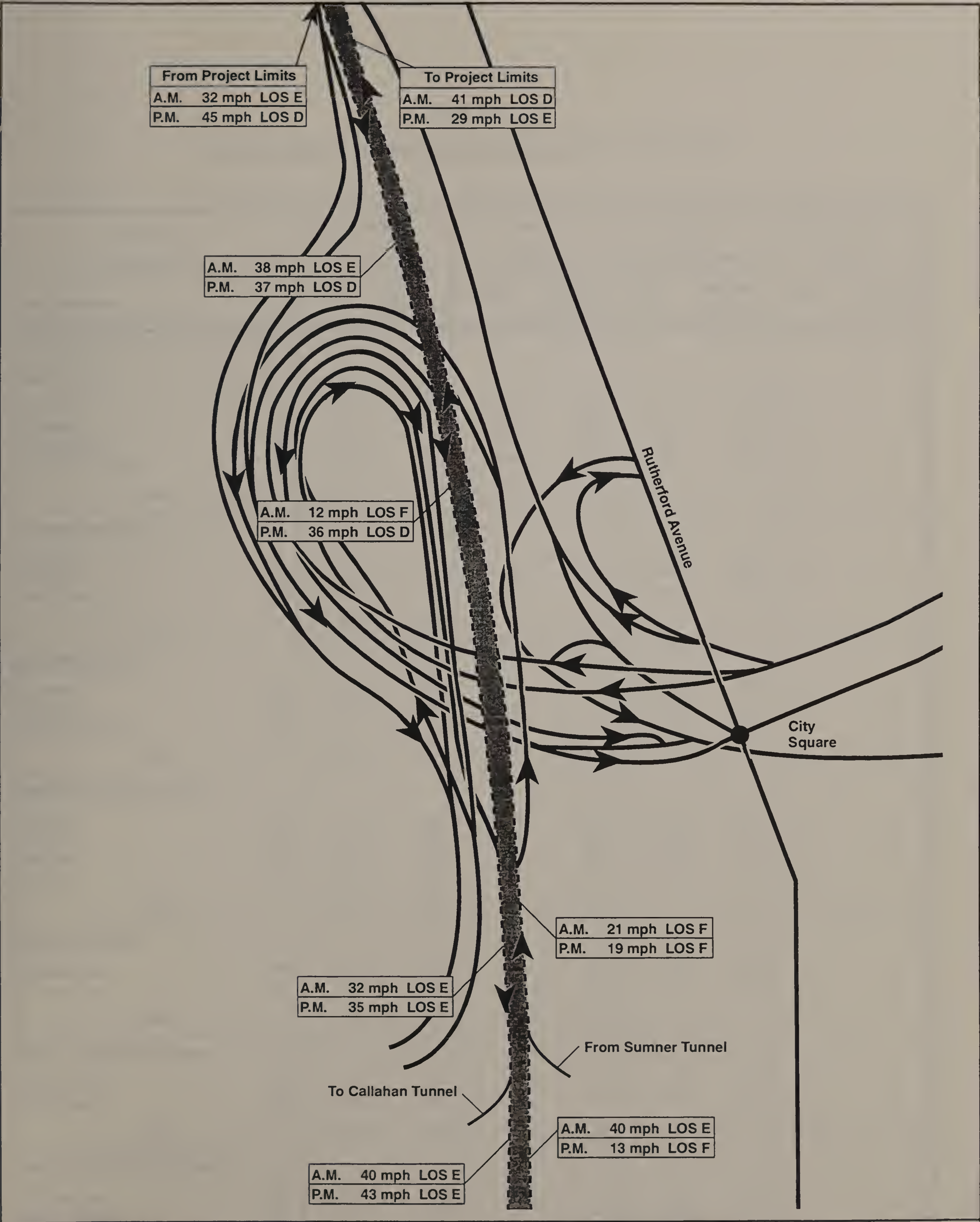

From Project Limits
A.M. 32 mph LOS E
P.M. 45 mph LOS D
To Project Limits
A.M. 41 mph LOS D
P.M. 29 mph LOS E
A.M. 38 mph LOS E
P.M. 37 mph LOS D
A.M. 12 mph LOS F
P.M. 36 mph LOS D
Rutherford Avenue
City Square
A.M. 21 mph LOS F
P.M. 19 mph LOS F
A.M. 32 mph LOS E
P.M. 35 mph LOS E
From Sumner Tunnel
To Callahan Tunnel
A.M. 40 mph LOS E
P.M. 13 mph LOS F
A.M. 40 mph LOS E
P.M. 43 mph LOS E

FIGURE 4.9

I-93 Operating Speeds And Level Of Service: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Not to Scale

Table 4.2

AM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

05-Dec-93		Volume		Delay		v/c Ratio		Level of Service	
04:34:06 PM		(vph)		(sec/veh)		(volume/capacity)		LOS	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
DOWNTOWN/NORTH STA./BEACON HILL									
Keany Square									
Causeway	EB	480	430	288	259	1.35	1.30	F	F
Commercial	WB	310	340	305	258	1.41	1.37	F	F
N.Washington	NB	970	1070	283	237	1.41	1.37	F	F
Charlestown Bridge	SB	2340	2650	108	209	1.04	1.32	F	F
Totals-		4100	4480	186	224			F	F
Causeway/Surface NB									
Causeway	EB	450	410	14	8	0.27	0.18	B	B
Causeway	WB	1210	1330	18	11	0.72	0.58	C	B
Surface Artery	NB	1020	540	17	22	0.69	0.58	C	C
Totals-		2680	2280	17	13			C	B
Causeway/Surface SB									
Causeway	EB	850	890	8	12	0.50	0.43	B	B
Causeway	WB	2170	1870	5	2	0.59	0.44	A	A
MBTA Garage Exit	SB	100	30	30	32	0.59	0.44	D	D
Totals-		3120	2790	6	6			B	B
Causeway/Merrimac/Lomasney									
Staniford	EB	770	1060	73	125	0.78	0.88	F	F
Causeway	WB	1120	1030	64	136	0.96	1.04	F	F
Merrimac	NB	1180	840	96	206	1.13	1.29	F	F
Lomasney	SB	1520	1750	60	106	0.88	0.99	E	F
Totals-		4590	4680	73	135			F	F
Surface SB/Valenti									
N.Washington	WB	2130	2190	35	44	1.03	1.06	D	E
Surface Artery	SB	630	630	58	65	1.03	1.06	E	F
Totals-		2760	2820	41	49			E	E
Sumner Tunnel/N.Washington									
Sumner Tunnel	EB	450	370	115	57	0.97	0.87	F	E
N Washington	NB	2340	2090	90	19	1.17	0.99	F	C
Totals-		2790	2460	94	24			F	C
New Chardon/Surface SB/Sumner									
New Chardon	EB	1030	1100	16	19	0.59	0.70	C	C
Sumner Tunnel	WB	1310	1120	59	42	1.08	1.02	E	E
Surface Artery	SB	2760	2820	52	31	1.08	1.02	E	D
Totals-		5100	5040	46	31			E	D

Table 4.2 (Cont.)

AM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

05-Dec-93 04:34:06 PM		Volume (vph)		Delay (sec/veh)		v/c Ratio (volume/capacity)		Level of Service LOS	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
DOWNTOWN/NORTH STA./BEACON HILL									
New Sudbury/Surface SB									
New Sudbury	EB	990	1510	3	3	0.40	0.45	A	A
Suface Artery	SB	220	220	29	30	0.56	0.58	D	D
Totals-		1210	1730	8	7			B	B
New Sudbury/Cross/Sudbury On									
New Sudbury	EB	390	900	27	61	0.60	0.89	D	F
Cross	NB	1690	1830	7	50	0.60	0.98	B	E
Totals-		2080	2730	11	53			B	E
New Chardon/Congress									
New Chardon	WB	2370	2200	81	58	1.15	1.09	F	E
Congress	NB	2240	980	60	53	0.74	0.75	E	E
Merrimac	SB	480	510	106	82	1.15	1.09	F	F
Totals-		5090	3690	78	61			F	F
New Sudbury/Congress									
New Sudbury	EB	1360	1490	55	168	1.02	1.25	E	F
Congress	NB	1690	1650	44	147	1.04	1.25	E	F
Congress	SB	980	1220	30	87	0.49	0.69	D	F
Totals-		4030	4360	44	137			E	F
State/Surface SB									
State	WB	290	250	34	36	0.61	0.63	D	D
Surface Artery	SB	3010	2990	5	4	0.70	0.67	A	A
Totals-		3300	3240	7	6			B	B
State/Surface NB									
Sumner Tunnel	WB	300	300	25	26	0.75	0.76	C	D
N Washington	NB	1880	1920	11	11	0.75	0.76	B	B
Totals-		2180	2220	13	13			B	B

Table 4.2 (Cont.)

AM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

05-Dec-93 04:37:39 PM		Volume *(vph)*		Delay *(sec/veh)*		v/c Ratio *(volume/capacity)*		Level of Service *LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
DOWNTOWN/NORTH STA./BEACON HILL									
Lomasney/Nashua									
Martha Way	EB	1060	1510	13	222	0.69	1.21	B	F
Lomasney	WB	990	1580	190	219	0.58	1.15	F	F
North Station Garage	NB	750	n/a	542	n/a	1.56	n/a	F	
Nashua	SB	1020	340	430	312	1.50	1.42	F	F
Totals-		3820	3430	271	230			F	F
Nashua/Ramp CN-L									
Nashua St.	EB	n/a	550	n/a	19	n/a	0.56	n/a	C
Nashua St.	WB	n/a	810	n/a	24	n/a	0.83	n/a	C
Ramp CN-L	SB	n/a	1410	n/a	14	n/a	0.79	n/a	B
Totals-		n/a	2770	n/a	18			n/a	C
Leverett Circle									
Charles/Storrow	EB	1270	1710	17	56	0.76	0.99	C	E
Nashua	WB	1730	2680	21	106	0.96	1.15	C	F
Charles River Dam	SB	600	1410	42	128	1.08	1.22	E	F
Totals-		3600	5800	23	97			C	F
State/Congress									
State	WB	1260	1270	15	16	0.71	0.73	B	C
Congress	NB	880	930	20	21	0.78	0.80	C	C
Congress	SB	1240	1260	18	17	0.59	0.61	C	C
Totals-		3380	3460	17	18			C	C
Cambridge/New Chardon									
New Chardon	EB	1600	1540	35	55	1.07	1.07	D	E
New Chardon	WB	480	470	16	17	0.44	0.45	C	C
	NB	1010	1130	36	41	0.82	0.78	D	E
	SB	1160	970	48	65	1.07	1.07	E	F
Totals-		4250	4110	38	49			D	E
Cambridge/Sudbury									
Cambridge	EB	2270	2370	11	12	0.56	0.60	B	B
Cambridge	WB	740	750	26	28	0.80	0.85	D	D
Sudbury St.	NB	160	180	38	42	0.81	0.86	D	E
Totals-		3170	3300	16	17			C	C

Tabie 4.2 (Cont.)

AM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

05-Dec-93 04:37:39 PM		Volume (vph)		Delay (sec/veh)		v/c Ratio (volume/capacity)		Level of Service LOS	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
DOWNTOWN/NORTH STA./BEACON HILL									
Lomasnev/Nashua									
Martha Way	EB	1060	1510	13	222	0.69	1.21	B	F
Lomasney	WB	990	1580	190	219	0.58	1.15	F	F
North Station Garage	NB	750	n/a	542	n/a	1.56	n/a	F	
Nashua	SB	1020	340	430	312	1.50	1.42	F	F
Totals-		3820	3430	271	230			F	F
Nashua/Ramp CN-L									
Nashua St.	EB	n/a	550	n/a	19	n/a	0.56	n/a	C
Nashua St.	WB	n/a	810	n/a	24	n/a	0.83	n/a	C
Ramp CN-L	SB	n/a	1410	n/a	14	n/a	0.79	n/a	B
Totals-		n/a	2770	n/a	18			n/a	C
Leverett Circle									
Charles/Storrow	EB	1270	1710	17	56	0.76	0.99	C	E
Nashua	WB	1730	2680	21	106	0.96	1.15	C	F
Charles River Dam	SB	600	1410	42	128	1.08	1.22	E	F
Totals-		3600	5800	23	97			C	F
State/Congress									
State	WB	1260	1270	15	16	0.71	0.73	B	C
Congress	NB	880	930	20	21	0.78	0.80	C	C
Congress	SB	1240	1260	18	17	0.59	0.61	C	C
Totals-		3380	3460	17	18			C	C
Cambridge/New Chardon									
CNew Chardon	EB	1600	1540	35	55	1.07	1.07	D	E
New Chardon	WB	480	470	16	17	0.44	0.45	C	C
	NB	1010	1130	36	41	0.82	0.78	D	E
	SB	1160	970	48	65	1.07	1.07	E	F
Totals-		4250	4110	38	49			D	E
Cambridge/Sudburv									
Cambridge	EB	2270	2370	11	12	0.56	0.60	B	B
Cambridge	WB	740	750	26	28	0.80	0.85	D	D
Sudbury St.	NB	160	180	38	42	0.81	0.86	D	E
Totals-		3170	3300	16	17			C	C

Table 4.2 (Cont.)

AM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

05-Dec-93 04:37:39 PM		Volume		Delay		v/c Ratio		Level of Service	
		(vph)		*(sec/veh)*		*(volume/capacity)*		*LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
BEACON HILL									
Cambridge/Staniford									
Cambridge	EB	1640	1710	22	34	0.75	0.77	C	D
Cambridge	WB	1410	1230	42	73	1.02	1.11	E	F
Staniford	SB	870	1060	41	52	0.84	0.94	E	E
Totals-		3890	4000	34	51			D	E
Charles Circle Eastbound									
Longfellow Bridge	EB	900	860	45	73	1.00	1.09	E	F
Storrow Dr. EB Off Ramp	NB	1470	1700	33	59	1.00	1.09	D	E
Storrow Dr. EB Off Ramp	SB	900	960	45	72	1.00	1.09	E	F
Totals-		3270	3520	40	66			D	F
Charles Circle Wesrbound									
Cambridge	WB	1040	920	8	10	0.40	0.39	B	B
Charles	NB	890	950	12	11	0.28	0.27	B	B
Totals-		1930	1870	10	10			B	B
CHARLESTOWN									
City Square									
I-93 C-L Exit	EB	1720	n/a	756	n/a	1.77	n/a	F	n/a
Chelsea	WB	1650	1560	605	73	1.62	1.08	F	F
Charlestown Bridge	NB	1480	1570	83	11	1.03	0.57	F	B
Rutherford	SB	3520	3830	422	38	1.36	1.00	F	D
Totals-		8370	6960	464	39			F	D
Rutherford/I-93 Connector									
Connector	EB	600	1110	176	125	1.09	1.12	F	F
Rutherford	NB	2410	1130	29	60	0.59	0.48	D	E
Rutherford	SB	4320	4100	73	144	1.11	1.21	F	F
Totals-		7330	6340	66	125			F	F
Rutherford/Gilmore									
Gilmore	EB	1430	1320	19	13	0.89	0.74	C	B
Austin	WB	370	350	44	31	0.93	0.78	E	D
Rutherford	NB	1040	790	12	13	0.80	0.68	B	B
Rutherford	SB	850	960	4	6	0.42	0.51	A	B
Totals-		3690	3420	16	13			C	B

Table 4.2 (Cont.)

AM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

05-Dec-93 04:37:39 PM		Volume (vph)		Delay (sec/veh)		v/c Ratio (volume/capacity)		Level of Service LOS	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
CHARLESTOWN									
I-93/U.S. Rt.1/Connector									
Connector	WB	n/a	1210	n/a	14	n/a	0.93	n/a	B
Ramp to/from U.S. Rt.1	NB	n/a	940	n/a	6	n/a	0.80	n/a	B
Ramp to/from I-93	SB	n/a	170	n/a	66	n/a	0.93	n/a	F
Totals-		n/a	2320	n/a	14			n/a	B
Cambridge/Maffa Way-Sullivan Square									
Cambridge St.	EB	1390	1400	116	182	1.21	1.30	F	F
Cambridge St.	WB	1310	500	12	11	0.51	0.18	B	B
Maffa Way	SB	1940	1700	97	181	1.14	1.30	F	F
Totals-		4640	3600	79	158			F	F
Ramp C-L/Cambridge St.									
Cambridge St.	EB	n/a	1020	n/a	56	n/a	1.06	n/a	E
Cambridge St.	WB	n/a	430	n/a	18	n/a	0.45	n/a	C
Ramp C-L	NB	n/a	1430	n/a	42	n/a	0.89	n/a	E
Totals-		n/a	2880	n/a	43			n/a	E
CITY OF CAMBRIDGE									
O'Brien/Gilmore Bridge									
Edwin Land Blvd.	EB	810	960	265	263	0.46	1.30	E	F
Gilmore Bridge	WB	1620	1710	340	404	1.44	1.48	F	F
Charles River Dam	NB	630	840	237	349	1.08	1.06	F	F
O'Brien	SB	1760	1880	162	175	0.92	0.93	F	F
Totals-		4820	5390	249	290			F	F
Lechmere Square									
Cambridge St.	EB	880	930	42	53	0.70	0.76	E	E
Cambridge St	WB	400	410	25	45	0.84	0.98	C	E
O'Brien	NB	1060	1200	59	81	0.92	1.00	E	F
O'Brien	SB	2090	1990	78	85	1.10	1.08	F	F
Totals-		4430	4530	62	74			F	F
Cambridge/First									
Cambridge St.	EB	770	780	27	21	0.85	0.77	D	C
Cambridge St	WB	930	930	16	11	0.69	0.63	C	B
First	NB	740	760	24	21	0.77	0.71	D	C
Totals-		2490	2470	22	17			C	C
Broadway/Third Street									
Third St.	WB	420	430	95	149	0.66	0.85	F	F
Broadway	NB	1230	1780	165	191	1.28	1.32	F	F
Broadway	SB	1720	1290	107	118	0.84	0.79	F	F
Totals-		3370	3500	127	159			F	F
Third St./Binney St.									
Binney St.	EB	750	870	86	170	0.94	1.04	F	F
Binney St.	WB	270	310	11	11	0.15	0.17	B	B
Third St.	NB	680	670	15	15	0.54	0.53	B	B
Third St	SB	660	750	107	222	1.17	1.34	F	F
Totals-		2360	2600	62	124			F	F
Third St./Cambridge St.									
Cambridge St.	EB	690	580	490	796	1.58	1.77	F	F
Cambridge St.	WB	710	720	10	12	0.51	0.52	B	B
Third St.	NB	250	380	19	63	0.58	1.05	C	F
Third St	SB	1200	1250	470	766	1.58	1.77	F	F
Totals-		2850	2930	320	495			F	F

Source: Bechtel/Parsons Brinckerhoff

Table 4.3
PM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

11-Dec-93 06:16:40 PM		Volume (vph)		Delay (sec/veh)		v/c Ratio (volume/capacity)		Level of Service LOS	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
DOWNTOWN/NORTH STA./BEACON HILL									
Keany Square									
Causeway	EB	940	750	149	61	1.16	0.84	F	F
Commercial	WB	480	440	266	94	1.38	1.12	F	F
N.Washington	NB	1380	810	250	82	1.38	1.12	F	F
Charlestown Bridge	SB	810	810	146	59	1.03	0.83	F	E
Totals-		3610	2810	203	72			F	F
Causeway/Surface NB									
Causeway	EB	860	670	15	13	0.48	0.36	B	B
Causeway	WB	780	670	14	13	0.44	0.36	B	B
Surface Artery	NB	650	490	15	14	0.46	0.34	B	B
Totals-		2290	1830	15	14			B	B
Causeway/Surface SB									
Causeway	EB	1130	1060	14	13	0.56	0.54	B	B
Causeway	WB	1490	1220	15	12	0.68	0.50	C	B
MBTA Garage Exit	SB	820	750	17	19	0.70	0.72	C	C
Totals-		3340	3030	15	14			C	B
Causeway/Merrimac/Lomasney									
Staniford	EB	1370	1540	22	30	0.68	0.82	C	D
Causeway	WB	1120	830	45	28	0.95	0.76	E	D
Merrimac	NB	520	450	35	51	0.80	0.91	D	E
Lomasney	SB	1050	1230	42	27	0.77	0.75	E	D
Totals-		4060	4050	35	31			D	D
Surface SB/Valenti									
N. Washington	WB	1160	1130	8	9	0.62	0.62	B	B
Surface Artery	SB	570	630	24	23	0.62	0.62	C	C
Totals-		1730	1730	14	14			B	B
Sumner Tunnel/N Washington									
Sumner Tunnel	EB	270	300	86	37	0.92	0.67	F	D
N. Washington	NB	2440	1680	55	9	1.10	0.81	E	B
Totals-		2710	1980	58	13			E	B
New Chardon/Surface/SB/Sumner									
New Chardon	EB	1650	1610	15	16	0.78	0.77	B	C
Sumner Tunnel	WB	960	850	14	13	0.65	0.58	B	B
Surface Artery	SB	1730	1760	19	18	0.78	0.77	C	C
Totals-		4340	420	16	16			C	C

Table 4.3 (Cont.)
PM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

11-Dec-93		Volume		Delay		v/c Ratio		Level of Service	
06:16:40 PM		*(vph)*		*(sec/veh)*		*(volume/capacity)*		*LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
New Sudbury/Surface SB									
New Sudbury	EB	1140	1580	3	4	0.53	0.47	A	A
Surface Artery	SB	170	280	35	28	0.71	0.58	D	D
Totals-		1310	1860	8	8			B	B
New Sudbury/Surface/Cross/Sudbury On									
New Sudbury	EB	340	1140	29	246	0.61	1.23	D	F
Cross	NB	182	2030	6	133	0.61	1.15	B	F
Totals-		2160	3170	10	173			B	F
New Chardon/Congress									
New Chardon	NB	1470	1340	30	22	0.96	0.85	F	C
Congress	WB	2790	960	24	17	0.53	0.56	F	C
Merrimac	SB	760	840	40	28	0.96	0.85	D	D
Totals-		5020	3140	30	22			C	C
New Sudbury/Congress									
New Sudbury	EB	22	2440	302	361	1.23	1.32	F	F
Congress	NB	1270	1250	363	467	1.49	1.58	F	F
Congress	SB	1270	1430	195	265	0.82	0.91	F	F
Totals-		4820	5120	290	361			F	F
State/Surface SB									
State	WB	600	590	32	30	0.72	0.67	D	D
Surface Artery	SB	2430	2350	7	7	0.63	0.62	B	B
Totals-		303	2940	12	12			B	B
State/Surface NB									
State	WB	420	430	38	39	0.94	0.95	D	D
Surface Artery	NB	2220	2250	19	19	0.94	0.95	C	C
Totals-		2640	2680	22	22			C	C

Table 4.3 (Cont.)
PM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

11-Dec-93		Volume		Delay		v/c Ratio		Level of Service	
06:16:40 PM		*(vph)*		*(sec/veh)*		*(volume/capacity)*		*LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
DOWNTOWN/NORTH STA./BEACON HILL									
Lomasney/Nashua									
Martha Way	EB	1010	1000	126	42	1.21	0.90	F	E
Lomasney	WB	460	770	27	44	0.50	0.74	D	E
North Station Garage	NB	1100	n/a	91	n/a	1.08	n/a	F	
Nashua	SB	740	730	78		0.83	1.01	F	E
Totals-		3310	2500	90	44			F	E
Nashua/Ramp CN-L									
Nashua	EB	n/a	90	n/a	5	n/a	0.05	n/a	A
Nashua	WB	n/a	1420	n/a	9	n/a	0.73	n/a	B
Ramp CN-L	SB	n/a	480	n/a	23	n/a	0.60	n/a	C
Totals-		n/a	1990	n/a	12			n/a	B
Leverett Circle									
Charles/Storrow	EB	1400	2010	77	214	0.97	1.24	F	F
Nashua	WB	1680	2880	120	122	1.13	1.15	F	F
Charles River Dam	SB	1070	1240	128	258	1.26	1.39	F	F
Totals-		4150	6130	108	181			F	F
State/Congress									
State	WB	1080	1100	17	17	0.68	0.66	C	C
Congress	NB	820	860	15	15	0.61	0.64	B	B
Congress	SB	1500	1480	16	16	0.66	0.65	C	C
Totals-		3400	3440	16	16			C	C
Cambridge/New Chardon									
Cambridge	EB	2010	2000	32	31	1.01	1.00	D	D
Cambridge	WB	570	600	12	12	0.41	0.43	B	B
New Chardon	NB	880	870	56	40	0.99	0.85	E	D
New Chardon	SB	1380	1120	43	45	1.01	1.00	E	E
Totals-		4840	4590	37	34			D	D
Cambridge/N.Sudbury									
Cambridge	EB	2640	2650	58	79	0.80	0.85	E	F
Cambridge	WB	790	860	92	116	1.08	1.11	F	F
Sudbury	NB	390	440	106	133	1.14	1.20	F	F
Totals-		3820	3950	70	93			F	F

Table 4.3 (Cont.)
PM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

11-Dec-93		Volume		Delay		v/c Ratio		Level of Service	
06:16:40 PM		*(vph)*		*(sec/veh)*		*(volume/capacity)*		*LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
BEACON HILL									
Cambridge/Staniford									
Cambridge	EB	2010	2100	18	33	0.87	0.90	C	D
Cambridge	WB	1630	1400	30	77	0.98	1.12	D	F
Staniford	SB	880	1000	41	57	0.93	0.93	E	E
Totals		4520	4500	27	53			D	E
Charles Circle Eastbound									
Longfellow Bridge	EB	1530	1810	20	57	0.86	1.08	C	E
Storrow Dr. EB Off-Ramp	NB	620	1120	30	63	0.86	1.08	D	F
Storrow Dr. WB Off-Ramp	SB	950	800	27	71	0.86	1.08	D	F
Totals		3100	3730	24	62			C	F
Charles Circle Westbound									
Cambridge	WB	1670	1610	3	2	0.48	0.45	A	A
Charles	NB	490	850	21	18	0.36	0.43	C	C
Totals		2160	2460	7	8			B	B
CHARLESTOWN									
City Square									
I-93 C-Exit	EB	1390	n/a	783	n/a	1.79	n/a	F	n/a
Chelsea	WB	1550	1470	682	70	1.63	1.02	F	F
Charlestown Bridge	NB	2550	1760	687	60	1.63	0.94	F	E
Rutherford	SB	2290	2600	197	46	0.92	0.90	F	E
Totals		7780	5830	561	56			F	E
Rutherford/I-93 Connector									
Connector	EB	870	1070	754	94	1.53	1.12	F	F
Rutherford	NB	3170	1670	167	33	0.83	0.54	F	D
Rutherford	SB	3220	3040	281	63	1.12	1.09	F	F
Totals		7260	5780	283	60			F	E
I-93/U.S Rt.1/Connector									
Connector	WB	n/a	1370	n/a	58	n/a	1.08	n/a	E
Ramp to/from U.S. Rt.1	NB	n/a	830	n/a	5	n/a	0.72	n/a	A
Ramp to/from I-93	SB	n/a	240	n/a	109	n/a	1.08	n/a	F
Totals-		n/a	2460	n/a	45			n/a	E
Cambridge/Maffa Way-Sullivan Sq.									
Cambridge St.	EB	1340	1370	23	40	0.97	1.04	C	D
Cambridge St.	WB	1110	370	8	7	0.51	0.21	B	B
Ramp C-L	NB	1230	1050	37	49	0.96	1.04	D	E
Totals-		3680	2790	23	39			C	D
Ramp C-L/Cambridge St.									
Cambridge St.	EB	n/a	1070	n/a	115	n/a	1.19	n/a	F
Cambridge St.	WB	n/a	370	n/a	19	n/a	0.41	n/a	C
Staniford	NB	n/a	1580	n/a	99	n/a	1.01	n/a	F
Totals-		n/a	3020	n/a	95			n/a	F

Table 4.3 (Cont.)
PM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

11-Dec-93 06:47:27 PM		Volume		Delay		v/c Ratio		Level of Service	
		(vph)		*(sec/veh)*		*(volume/capacity)*		*LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
CHARLESTOWN									
Rutherford/Gilmore									
Gilmore	EB	1410	1370	30	16	0.86	0.76	D	C
Austin	WB	410	460	70	27	1.05	0.74	F	D
Rutherford	NB	1220	830	43	18	1.05	0.79	E	C
Rutherford	SB	370	510	5	8	0.22	0.30	A	B
Totals-		3410	3170	37	17			D	C
I-93/U.S Rt. 1/Connector									
Connector	WB	n/a	1390	n/a	58	n/a	1.08	n/a	E
Ramp to/from U.S. Rt.1	NB	n/a	830	n/a	5	n/a	0.72	n/a	A
Ramp to/from I-93	SB	n/a	240	n/a	109	n/a	1.08	n/a	F
Totals-		n/a	2460	n/a	45			n/a	E
Cambridge/Maffa Way-Sullivan Sq.									
Cambridge St.	EB	1340	1370	23	40	0.97	1.04	C	D
Cambridge St.	WB	1110	370	8	7	0.51	0.21	B	B
Ramp C-L	NB	1230	1050	37	49	0.96	1.04	D	E
Totals-		3680	2790	23	39			C	D
Ramp C-L/Cambridge St.									
Cambridge St.	EB	n/a	1070	n/a	115	n/a	1.19	n/a	F
Cambridge St.	WB	n/a	370	n/a	19	n/a	0.41	n/a	C
Staniford	NB	n/a	1580	n/a	99	n/a	1.01	n/a	F
Totals-		n/a	3020	n/a	95			n/a	F

Table 4.3 (Cont.)
PM PEAK HOUR INTERSECTION OPERATIONS - YEAR 2010

11-Dec-93		Volume		Delay		v/c Ratio		Level of Service	
06:47:27 PM		*(vph)*		*(sec/veh)*		*(volume/capacity)*		*LOS*	
Name/Approach		Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
CITY OF CAMBRIDGE									
O'Brien/Gilmore Bridge									
Edwin Land Blvd.	EB	1670	1250	330	246	1.31	1.08	F	F
Gilmore Bridge	WB	1300	1300	736	488	1.76	1.60	F	F
Charles River Dam	NB	1150	1130	440	275	1.24	1.12	F	F
O'Brien	SB	1390	1350	578	450	1.54	1.48	F	F
Totals-		5510	5030	513	371			F	F
Lechmere Square									
Cambridge Street	EB	1280	1400	262	219	0.99	0.92	F	F
Cambridge Street	WB	630	640	66	80	1.09	1.13	F	F
O'Brien	NB	990	730	420	393	1.43	1.37	F	F
O'Brien	SB	890	880	313	226	1.34	1.22	F	F
Totals-		3790	3650	284	232			F	F
Cambridge/First									
Cambridge St.	EB	690	680	35	54	0.94	1.03	D	E
Cambridge St.	WB	1070	1020	24	26	0.85	0.86	F	D
First	NB	960	1060	22	37	0.83	0.92	F	D
Totals-		2720	2760	26	37			F	D
Broadway/Third Street									
Third St.	WB	690	750	51	126	0.69	0.94	E	F
Broadway	NB	650	820	86	143	1.12	1.23	F	F
Broadway	SB	1690	2140	48	63	0.76	0.91	E	F
Totals-		3030	3710	57	93			E	F
Third St/Binney St.									
Binney St.	EB	570	490	26	27	0.61	0.59	D	D
Binney St.	WB	300	310	16	18	0.22	0.26	C	C
Third St.	NB	670	680	11	9	0.63	0.60	B	B
Third St.	SB	650	690	21	18	0.89	0.87	C	C
Totals-		2190	2170	18	17			C	C
Third St/Cambridge St									
Cambridge St.	EB	170	220	13	15	0.17	0.57	B	B
Cambridge St.	WB	710	630	13	13	0.54	0.51	B	B
Third St.	NB	360	300	12	10	0.50	0.41	B	B
Third St.	SB	620	700	12	12	0.54	0.57	B	B
Totals-		1860	1850	12	12			B	B

Source: Bechtel/Parsons Brinckerhoff

- Traffic volumes are approximately 35 to 50 percent lower for Scheme Z than the Preferred Alternative at the intersections of New Sudbury Street with the Surface Artery and Cross Street, due to the absence of the northbound on-ramp on New Sudbury Street in Scheme Z.

4.1.2(b) Traffic Operations

The impacts of both designs are compared in this section, in terms of both mainline highway and surface street traffic conditions. Traffic conditions forecast for 2010 are evaluated through a comparison of operating speed and LOS. These are standard measures of the quality of traffic operations.

Mainline Traffic Operations. Traffic conditions on the I-93 mainline are similar overall for both designs. Differences are outlined below. (Operating speeds and LOS for the AM and PM peak hours are presented in Figure 4.2 and in the Transportation Appendix.)

AM Peak Hour: In the AM peak hour, northbound operating speeds on the segment of the mainline crossing the river are forecast to be 29 mph with Scheme Z, as compared to 40 mph with the Preferred Alternative. The increase in speeds associated with the Preferred Alternative represents an improvement in LOS. Average northbound speeds for both designs range from 41 to 45 mph in the AM peak hour, for the entire distance from the Charles River to Sullivan Square at the northern Project limit.

In the southbound direction, AM peak hour speeds (for general-purpose traffic) are lower with the Preferred Alternative than with Scheme Z on the segment of I-93 to the north of the Tobin Bridge on-ramp (north of the Charles River). This impact results from a capacity constraint where the Tobin Bridge on-ramp merges with the southbound mainline; in addition, allocating a southbound lane for exclusive HOV use reduces the capacity available for general-purpose traffic. General-purpose traffic operates at 32 to 33 mph with Scheme Z, as compared to 17 mph with the Preferred Alternative. The reduced operating speeds are attributed to the inclusion of a southbound HOV lane in the Preferred Alternative.

Scheme Z does not include a comparable mainline HOV facility. The implementing regulations of the Clean Air Act Amendments of 1990 encourage development of HOV facilities wherever appropriate. Accordingly, the Preferred Alternative incorporates a mainline HOV facility. For comparison purposes, if a mainline HOV facility were incorporated in Scheme Z a similar reduction in operation speeds would result.

South of the Tobin Bridge on-ramp, the speed drops to 18 mph with Scheme Z because of a high-volume ramp merge from Storrow Drive, then increases to the stable operating range of 29 to 40 mph across the Charles River and south to the Oliver Street off-ramp. The speed with the Preferred Alternative remains low, ranging from 12 to 20 mph across the Charles River to the Leverett Circle on-ramp because of a high-volume weave between this on-ramp and the Callahan Tunnel/Clinton Street off-ramp. South of this weaving section, Preferred Alternative speeds increase to the 28 to 30 mph range.

PM Peak Hour: Operating speeds in the northbound direction, south of and crossing the Charles River, are low for both Scheme Z and the Preferred Alternative, ranging from 10 to 19 mph. North of the Tobin Bridge off-ramp, speeds for both alternatives increase to the 28 to 44 mph range.

In the southbound direction in the PM peak hour, traffic operations are similar with both designs. To the south of the Charles River, speeds are in the 32- to 38-mph range, while north of the Charles River, speeds range from 36 to 45 mph.

On the southbound segment of I-93 crossing the Charles River, speeds are 35 to 38 mph with the Preferred Alternative and Scheme Z.

Operating speeds on Storrow Drive eastbound are the same with the Preferred Alternative and Scheme Z. Traffic in both the AM and PM peak hours moves at 24 to 28 mph with both the Preferred Alternative and Scheme Z.

Massachusetts Turnpike Connections: The Certificate of the Secretary of Environmental Affairs on the 1992 NPC requires that affected connections to the Massachusetts Turnpike (Masspike) be addressed in this FSEIS/R. Neither the Preferred Alternative nor Scheme Z provides additional connections to the Masspike, nor does either have a measurable impact on Masspike traffic conditions. Connections between the Masspike and Storrow Drive are several miles to the west of the Project limits, at the Beacon Park interchange in Allston, and require travelling via arterial roadways and a signalized intersection.

Daily traffic volume on Storrow Drive to the west of Clarendon Street is 5 percent lower for the Preferred Alternative.

Additional design options were considered by the BDRC in 1991 that would have shifted some of the functions performed by Storrow Drive to the Masspike. Analyses showed that these alternatives would not reduce traffic on Storrow Drive, or replace established connections among Storrow Drive, the Central Artery, and the Tobin Bridge. Downgrading the Storrow connections also could not improve traffic conditions on the Masspike, but would result in a small increase in Masspike traffic volume (1 to 2 percent), as confirmed by analysis performed in support of the BDRC. In summary, the design of the Charles River Crossing will have no discernible impact on the Masspike.

Intersections. For this FSEIS/R traffic operations have been analyzed at 25 intersections because of their potential sensitivity to changes in the design of the Charles River Crossing. These intersections are located in Beacon Hill, Charlestown, Cambridge, and the section of the downtown area to the north of State Street (see Tables 4.2 and 4.3, and Figure 4.7).

In the AM peak hour, 13 intersections operate at LOS F (defined as delays of 60 seconds or more) with Scheme Z, while 14 intersections operate at LOS F with the Preferred Alternative. In the PM peak hour, there are 10 intersections that operate at LOS F with Scheme Z, and nine intersections that operate at LOS F with the Preferred Alternative. Major intersections that operated at LOS F with both designs in both AM and PM peak hours include Keany Square, New Chardon and Congress Streets, Lomasney Way and Nashua Street, and O'Brien Highway and Gilmore Bridge. Traffic problems are experienced currently at most of these locations, as is documented in the 1991 FSEIS/R. Increased congestion at these locations will result from projected land use changes and employment growth that are independent of the Project.

Intersections that have a better LOS with the Preferred Alternative than with Scheme Z are as follows:

- Causeway Street/Surface Artery northbound (PM)
- Causeway Street/Merrimac Street/Lomasney Way (PM)
- Sumner Tunnel/North Washington Street (AM and PM)
- New Chardon Street/Surface Artery southbound (AM and PM)
- City Square (PM)
- Rutherford Avenue/Gilmore Bridge (AM)

Major improvements occur at Surface Artery southbound/ Valenti Way, New Chardon Street/Surface Artery southbound, Rutherford Avenue/Gilmore Bridge, New Sudbury/Congress Streets, and City Square, for the time periods noted. These improvements result from the inclusion of the New Sudbury Street on-ramp in the Preferred Alternative.

In contrast, there are five intersections where traffic volumes are higher and operating conditions are worse with the Preferred Alternative than with Scheme Z; these are as follows:

- Leverett Circle, because Scheme Z provides for an additional Storrow Drive to Central Artery southbound underpass movement
- New Sudbury/Cross Streets, at the portal to the New Sudbury Street on-ramp
- Charles Circle eastbound (due to superior operations on Storrow Drive eastbound through Leverett Circle, with Scheme Z)
- Keany Square (AM only) due to higher volume on the North Washington Street bridge for the Preferred Alternative, resulting from its superior City Square configuration
- Sullivan Square rotary due to changes in traffic patterns resulting from the location of northbound of northbound off-ramp at Cambridge Street

For the Preferred Alternative only, access to and from I-93 north of the river and the Tobin Bridge via Rutherford Avenue occurs through an at-grade signalized intersection at the Millers River beneath the I-93 viaduct. The LOS are A for the AM and B for the PM peak periods, respectively. The freeway-to-freeway movements between I-93 northbound and the Tobin Bridge are not accommodated at this intersection.

Generally, traffic operations on local and arterial streets are better with the Preferred Alternative than with Scheme Z.

4.1.3 Vehicle Miles/Hours Of Travel

VMT is a measure of the cumulative distance travelled by all vehicles in a designated area. VHT is a measure of the cumulative time travelled by all vehicles in a designated area, i.e., the time expended during the accumulation of VMT. The comparison of VMT and VHT for the alternatives provides an indication of the overall efficiency and quality of traffic operations, with significantly lower VMT and VHT reflecting more direct routing and less traffic congestion.

For the area affected by this study (Area North of Causeway Street), the VMT for Scheme Z exceeds the Preferred Alternative by 0.8 percent. For the original total Project study area, the VMT for Scheme Z exceeds the Preferred Alternative by 0.6 percent. For the expanded total Project study area, the VMT for Scheme Z exceeds the Preferred Alternative by 0.6 percent (see Table 4.4).

In contrast, the VHT for the Preferred Alternative exceeds Scheme Z by 0.9 percent. For the original total Project study area, the VHT for Scheme Z exceeds the Preferred Alternative by 0.3 percent (see Table 4.5).

The differences between the VMT and VHT for both the Preferred Alternative and Scheme Z are very small and in most cases the differences are essentially negligible. In this FSEIS/R, the methodology for computing VHT was significantly improved over that of the DSEIS/R by reconsidering non-truck-route speeds and other system improvements such that total VHT for both the Preferred Alternative and Scheme Z are at levels of some 25 percent lower in this FSEIS/R than in the DSEIS/R.

4.1.4 Truck Movements And Hazardous Cargo Routes

Truck movements are accommodated on all mainline tunnels, viaducts, and ramps of the Preferred Alternative and Scheme Z, with the exception of trucks carrying hazardous cargoes. It is MHD policy that hazardous cargo movements will be prohibited from all tunnel segments of the Central Artery. This is consistent with City of Boston regulations (see below) that place strict constraints on the surface and tunnel movements of vehicles carrying hazardous materials. No changes are expected to the existing primary hazardous cargo routes as a result of this Project.

City of Boston Regulations. On December 15, 1980, the City of Boston issued regulations for controlling the transportation of hazardous materials. These regulations were issued by the Fire Commissioner and the Commissioner of Health and Hospitals in compliance with Chapter 39 of the Ordinances of 1979 and under the authority granted by Massachusetts General Laws Chapters 111 and 148, and other applicable laws. These have been in effect since April 6, 1981. Title 720 CMR Section 8 has been adopted and incorporated in the City regulations as have, with some modifications, Federal Motor Carrier Safety Regulations 49 CFR 397.5, 397.7, 397.9, and 397.21.

In particular concerning the routing of hazardous cargo, 49 CFR 397.9(a) states that unless there is no practicable alternative, a motor vehicle containing hazardous materials must be operated over routes that do not go through or near heavily populated areas, places where crowds are assembled, tunnels, narrow streets, or alleys. It further states that operating convenience is not a basis for determining whether it is practicable to operate a motor vehicle in accordance with this regulation. Supplementing these regulations, the City of Boston has set forth additional regulations for certain types and quantities of hazardous materials as defined in Sections 4.01 and 4.02 of the City of Boston regulations.

City of Boston regulations state that use of City streets for the transportation of materials specified in Section 4.01 is prohibited where there is neither a point of origin or destination within the City. Further, they also state that use of City streets in the downtown area for transportation of materials specified in Sections 4.01 and 4.02 is prohibited during the hours between 6:00 AM and 8:00 PM daily, except Saturdays, Sundays, and holidays. The downtown area is defined as the area bounded by and including Massachusetts Avenue at the entrance ramp to the Southeast Expressway, the Southeast Expressway to the Kneeland Street ramp, along Kneeland Street to Atlantic Avenue, then along a line following the waterfront to the Charles River, along the Charles River to Massachusetts Avenue, and along Massachusetts Avenue to the Massachusetts Avenue entrance ramp to the Southeast Expressway. Exemptions to these regulations may be granted in accordance with a permit issued by the Fire Commissioner. However, regardless of any permits, the use of City streets in the downtown area is strictly prohibited between the hours of 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM.

Primary Cargo Routes. In September 1986, in accordance with the recently enacted Title III of the Superfund Amendments and Reauthorization Act of 1986, the City of Boston Local Emergency Planning Committee (LEPC), co-chaired by the Boston Fire Department (BFD) and the Mayor's Office, designated a system of primary hazardous cargo routes in the City of Boston. In the downtown area, there are two routes designated primary hazardous cargo routes. The first is I-93 to the Kneeland Street off-ramp, then Kneeland Street to Atlantic Avenue, Atlantic Avenue to Commercial Street, and Commercial Street to the North Washington Street bridge. The second is via the Massachusetts Avenue connector, then Massachusetts Avenue to Commonwealth Avenue. In South Boston, the primary hazardous cargo route is Summer Street and East First Street. In East Boston the primary hazardous cargo routes include Route 1A (not including the Sumner or Callahan Tunnels) and Maverick and Meridian Streets. In Charlestown, the primary hazardous cargo route includes Rutherford Avenue and Constitution Road. Hazardous cargoes also are transported on the Expressway system on at-grade and elevated segments of I-93, as well as on the Tobin Bridge.

Project Impacts To The Primary Hazardous Cargo Route System. It is not the intent or purpose of this document to designate routes. Rather, the purpose of this document is to describe accurately the impacts to the primary hazardous cargo route system of the possible full-build street and highway networks of the two river crossing options so that the Boston LEPC can take action as it deems necessary. When construction of the entire Project is complete, all of the existing primary hazardous cargo routes as designated by the Boston LEPC that are within the Project limits will be able to be used as they are today. In the downtown area, both the Kneeland Street/Atlantic Avenue/Commercial Street/Charlestown bridge and the Massachusetts Avenue connector/Massachusetts Avenue routes will be available for use the same as now. On these two routes there will be new and improved systems of ramps and other roadways, but all of the existing connections will remain intact. The primary hazardous cargo routes in South Boston and East Boston will remain intact and usable as they are today. The primary hazardous cargo route system under full-build conditions is illustrated in Figure 4.10.

The authority to designate hazardous cargo routes in the City of Boston rests solely with the Boston LEPC.

Connections To CANA Tunnels. In the DSEIS/R, mention was made of the discussion between MHD and BFD regarding the possibility of use by hazardous cargo vehicles of the tunnels being constructed as part of the CANA project, which is not part of this Project nor under its purview. This has since been resolved: the CANA tunnels, in compliance with Massachusetts State regulations, will not be open to use by vehicles carrying hazardous cargoes.

The design alternatives for the Charles River Crossing differ with respect to their impact on hazardous cargo route connections to the CANA tunnels. The tunnels will link I-93 northbound and Leverett Circle/Storrow Drive with Route 1/Tobin Bridge. Differences between the two designs are discussed below in greater detail.

For the Preferred Alternative, connections to the primary hazardous cargo route system in downtown Boston are identical to Scheme Z.

4.1.5 Safety

Year 2010 accident rates were estimated for both of the Charles River Crossing designs, using standard estimating formulas based on national statistics and local conditions. These rates are a function of the following factors: type of roadway facility; vehicular volume; number of lanes; frequency and length of weaving sections; vertical and horizontal alignment; presence of diverge and merge points; and whether or not a roadway section is in tunnel. The estimated number of annual accidents and accident rates per million VMT are shown in Table 4.6 for each design alternative. The slight difference in accident rates is attributed to the decreased length of roadway and the simplified alignment of the Preferred Alternative. The Preferred Alternative is forecast to have a lower accident rate and a lower number of total accidents.

Table 4.4

VEHICLE MILES OF TRAVEL (VMT) - YEAR 2010

Districts		Scheme Z		Preferred Alternative	
No.	**Name**	**Daily**	**Annual**	**Daily**	**Annual**
1	Government Center	56,505	18,703,155	56,644	18,749,164
2	Financial District	48,100	15,921,100	47,330	15,666,230
3	North End	180,019	59,586,289	203,948	67,506,788
4	North Station	247,725	81,996,975	255,608	84,606,248
5	West End	93,955	31,155,314	90,542	29,969,402
6	Beacon Hill	118,294	39,155,314	119,257	39,474,067
22	Charlestown	742,747	245,849,257	697,812	230,975,772
23	Navy Yard	26,220	8,678,820	23,237	7,691,447
24	East Cambridge/East Somerville	522,561	172,967,691	526,280	174,198,680
ANOC Districts		2,036,126	673,957,706	2,020,658	668,837,798
Original Area:					
Non-ANOC Districts		3,440,432	1,138,782,992	3,425,472	1,133,831,232
All Project Districts		5,476,558	1,812,740,698	5,446,130	1,802,669,030
Expanded Area:					
West Cambridge/West Somerville		1,811,673	599,663,763	1,798,636	595,348,516
Kenmore/Fenway		821,614	271,954,234	818,132	270,801,692
All Project Districts		8,109,845	2,684,358,698	8,062,898	2,668,819,238

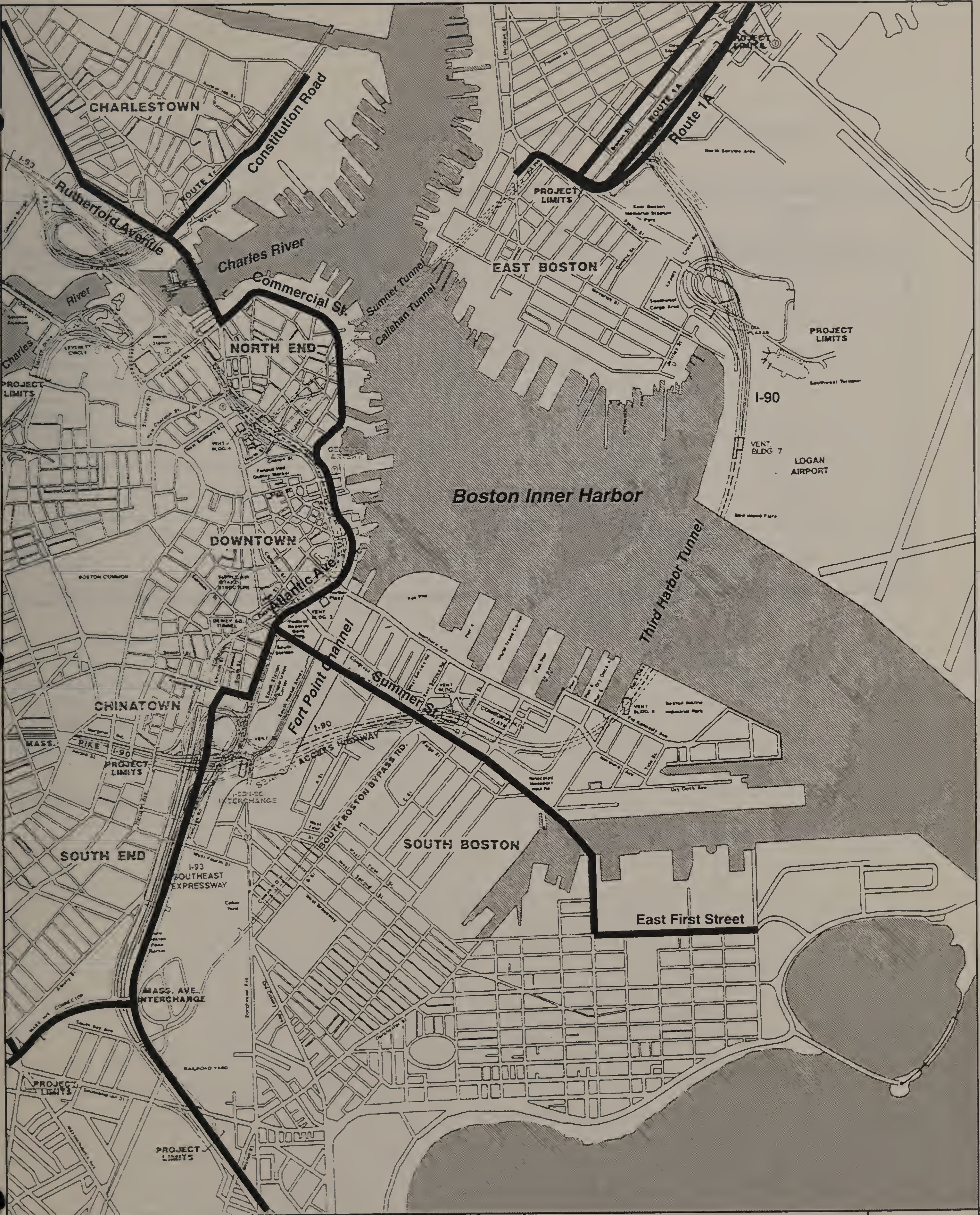
Source: Bechtel/Parsons Brinckerhoff

Table 4.5

VEHICLE HOURS OF TRAVEL (VHT) - YEAR 2010

Districts		Scheme Z		Preferred Alternative	
No.	**Name**	**Daily**	**Annual**	**Daily**	**Annual**
1	Government Center	4,724	1,563,644	4,570	1,512,670
2	Financial District	9,694	3,208,714	9,547	3,160,057
3	North End	7,417	2,455,027	8,509	2,816,479
4	North Station	10,043	3,324,233	10,700	3,541,700
5	West End	4,969	1,644,739	5,323	1,761,913
6	Beacon Hill	11,497	3,805,507	12,221	4,045,151
22	Charlestown	28,960	9,585,760	26,651	8,821,481
23	Navy Yard	1,469	486,239	1,133	375,023
24	East Cambridge/East Somerville	38,238	12,656,778	39,446	13,056,626
ANOC Districts		117,011	38,730,641	118,100	39,091,100
Original Area:					
Non-ANOC Districts		184,708	61,138,348	182,784	60,501,504
All Project Districts		301,719	99,868,989	300,884	99,592,604
Expanded Area:					
West Cambridge/West Somerville		106,666	35,306,446	104,728	34,664,968
Kenmore/Fenway		53,985	17,869,035	52,552	17,394,712
All Project Districts		462,370	153,044,470	458,164	151,652,284

Source: Bechtel/Parsons Brinckerhoff


CHARLESTOWN
Constitution Road
ROUTE 1
I-93
Rutherford Avenue
Charles River
River
Charles
Commercial St.
Sumner Tunnel
Callahan Tunnel
PROJECT LIMITS
ROUTE 1A
Route 1A
EAST BOSTON
PROJECT LIMITS
NORTH END
PROJECT LIMITS
I-90
VENT BLDG 7
LOGAN AIRPORT
Boston Inner Harbor
DOWNTOWN
BOSTON COMMON
Atlantic Ave.
Third Harbor Tunnel
Fort Point Channel
Summer St.
CHINATOWN
MASS. PIKE
I-90
PROJECT LIMITS
I-90
SEAPORT ACCESS HIGHWAY
I-93/I-90 INTERCHANGE
SOUTH BOSTON BYPASS RD.
SOUTH BOSTON
SOUTH END
I-93 SOUTHEAST EXPRESSWAY
East First Street
MASS. AVE. INTERCHANGE
RAILROAD YARD
PROJECT LIMITS
PROJECT LIMITS

FIGURE

4.10 Primary Hazardous Cargo Route System

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 800 1600 3200 4800 FEET

Table 4.6

ESTIMATED ANNUAL ACCIDENTS FOR MAJOR FREEWAY SECTIONS-YEAR 2010

Section/Alternative	Annual Vehicle Miles Travelled (VHT) (millions)	Total Estimated Accidents	Accident Rate (accidents/million VMT)
Northbound:			
Scheme Z	54.006	239	4.42
Preferred Alternative	60.705	261	4.29
Southbound:			
Scheme Z	41.187	199	4.83
Preferred Alternative	36.435	135	3.71
Eastbound:			
Scheme Z	19.036	107	5.60
Preferred Alternative	17.206	127	7.39
Westbound:			
Scheme Z	17.975	108	6.00
Preferred Alternative	16.962	119	7.02
Total:			
Scheme Z	132.204	652	4.93
Preferred Alternative	131.308	642	4.89

Northbound = Mainline NB from Essex/Northern On-Ramp to Sullivan Square
Southbound =Mainline SB from Sullivan Square to Sudbury On-Ramp
Eastbound = Storrow Drive EB from Blossom Street to Tobin Bridge at End of CANA Tunnel
Westbound = Tobin Bridge WB from Start of CANA Tunnel to Storrow Drive at Blossom Street

Source: Bechtel/Parsons Brinckerhoff

4.1.6 HOV Operations

This section addresses the impacts of the Preferred Alternative on HOV travel conditions. Operating characteristics are described for an HOV facility included in the Preferred Alternative as compared to Scheme Z. Several additional issues are discussed as follows:

- the inclusion of a PM peak northbound HOV lane
- integration of HOV planning within the Project limits with HOV planning for I-93 to the north of the Project limits
- provision of priority bus access from the HOV lane to Haymarket or another downtown terminal

4.1.6(a) Southbound HOV Lane

The Preferred Alternative provides for a southbound HOV lane on the I-93 mainline. Scheme Z, as designed, cannot accommodate a mainline HOV lane. The HOV lane incorporated in the Preferred Alternative extends between Sullivan Square and the Charles River bridge, a distance of approximately 1 mile, in approximately the same configuration as the existing I-93 HOV lane in this area. A barrier or raised median such as that currently in use for the existing southbound HOV lane separates the lane from general-purpose traffic. The lane terminates and joins the general-purpose lanes just prior to the bridge over the Charles River, to allow appropriate distances for traffic to change lanes for access.

With the Preferred Alternative, substantial HOV volumes use both the parallel connector viaduct (to Storrow Drive, Nashua Street, Tobin Bridge, and Charlestown) and the I-93 mainline. Traffic flow on the connector is substantially below capacity for both HOVs and general-purpose traffic. The connector serves as the primary bus route to downtown Boston. Average operating speed in the dedicated mainline HOV lane is 34 mph, since it bypasses the capacity constraint at the merger of the Tobin Bridge on-ramps with the I-93 southbound mainline.

The southbound mainline HOV lane carries approximately 45,500 people in 17,500 vehicles per day with the Preferred Alternative, for an average vehicle occupancy rate of 2.6 persons per vehicle. HOVs constitute 36 percent of all vehicles on the segment of I-93 between Sullivan Square and the Charles River bridge, but carry 49 percent of the total number of people travelling in all vehicles. The HOV lane carries approximately 1,650 and 1,280 vehicles in the AM and PM peak hours, respectively. Currently, MHD has not determined whether the lane will be operated in the PM peak hour. This decision depends in part upon compatibility with a potential contraflow lane that has been proposed for I-93 to the north of the Project limits. (A contraflow lane is borrowed from the off-peak direction general-purpose lanes for HOV use.) The projected level of use exceeds the 800-vehicle per peak hour minimum volume threshold recommended for a dedicated HOV lane.

For the AM peak hour, travel time for vehicles in the HOV lane (3.5 minutes) would be about one-half of that for vehicles in the general-purpose lanes (6.5 minutes) The total person hours of travel for the combination of HOV vehicles and general-purpose vehicles (634 hours), however, would be slightly higher than the case without an HOV lane (560 hours). Increasing HOV lane use would increase total person hours for the HOV system to those of a non-HOV system.

Extension Of The Southbound HOV Lane. As described in the report, *High-Occupancy Vehicle Feasibility Study,* released in December 1992, MHD will implement northward extension of the existing southbound HOV lane as a short-range measure. Assuming that this extension would be supplemented by a contraflow lane upon completion of the Charles River Crossing, as is recommended in the above report, the short-range recommendation would have no bearing on the HOV lane included in the Preferred Alternative.

4.1.6(b) Northbound HOV Operations

Neither the Preferred Alternative nor Scheme Z includes a dedicated northbound HOV lane within the Project limits. Both engineering design constraints and the absence of substantial travel time benefits for HOVs are the principal factors that have governed the design treatment of northbound HOV operations. A northbound HOV lane would provide minimal travel time savings for HOVs, and therefore would not result in increased HOV use.

Design Issues. The basic design constraint to providing a northbound HOV lane is integrating the lane entrance with I-93 mainline entrance and exit ramps. Both designs include general-purpose entrance and/or exit ramps on both the left and right sides of the I-93 mainline, on the segment of the mainline to the north of the Charles River bridge, as described more fully below.

Preferred Alternative: A feature of the Preferred Alternative north of the Charles River is a left-sided off-ramp to the Tobin Bridge, followed by a merge with a right-sided entrance ramp from New Sudbury Street, followed by a right-sided off-ramp to Cambridge Street, and a left-sided entrance ramp from Tobin Bridge, City Square, and Storrow Drive/Leverett Circle.

Scheme Z: A two-lane, right-sided exit ramp to the Tobin Bridge and City Square is located within 200 feet of the north bank of the Charles River, after which the mainline merges on the right with a Tobin Bridge/City Square entrance ramp. Another 1,000 feet to the north, the mainline merges with a left-sided entrance ramp from Storrow Drive/Leverett Circle.

A northbound HOV lane must begin to the north of the entrance ramp from Storrow Drive/Leverett Circle, for the following reasons:

- It is not possible to provide a dedicated HOV lane within the segment of the I-93 mainline where there will be the concentration of left- and right-sided ramps as described above, because the lane would conflict with movements to or from these ramps.

- A northbound HOV lane should be designed to serve the major traffic movements coming from the ramps entering I-93 to the north of the Charles River, particularly the large volume of vehicles coming from Storrow Drive/Leverett Circle, rather than just the traffic crossing the Charles River on the I-93 mainline.

Continuity with concepts developed by MHD in a separate study for a northbound contraflow lane between the northern Project limits and Route 128 supports beginning the lane to the north of the double-deck segment of the highway, approximately 1 mile to the north of the Charles River. To the north of the double-deck structure, the northbound and southbound mainline lanes are at the same elevation (side by side), which is required to effect the crossover of vehicles at the entrance and exit points to/from a contraflow lane.

Traffic Conditions. There is little need for a northbound HOV lane within the Project limits, independent of design constraints. Traffic forecasts indicate that northbound lanes within the Project limits will operate without substantial traffic delays. Therefore, a northbound dedicated HOV lane would provide negligible benefits for HOVs, and would not meet standard planning criteria. Speeds in the general-purpose lanes are forecast to be in the range of 40 to 45 mph for the new design alternatives, from the Gilmore Bridge to the Project limits.

4.1.6(c) Compatibility With Proposed HOV Facilities To The North Of The Project Limits

In the MHD report cited above, a contraflow lane, to be implemented through the use of moveable concrete barriers, is identified as the most feasible long-range option for providing an HOV lane on I-93 between the Charles River Crossing and Route 128 north of the Project limits. This recommendation was developed in response to a Massachusetts air pollution control regulation (310 CMR 7.37) requiring the evaluation of an extension of the existing I-93 southbound lane northward toward Route 128, and the addition of a northbound HOV lane extending toward Route 128. HOV issues confined to the segment of I-93 within the Project limits were addressed in Sections 4.1.6(a) and 4.1.6(b). This section addresses issues affecting continuity between the design of the Charles River Crossing and the proposed contraflow lane, which would be located north of the Project limits. These issues concern storage of a vehicle used for placement of moveable barriers, provision of an enforcement area, and transitions between facilities within and beyond the Project limits.

Southbound. The contraflow lane proposed to the north of the Project limits cannot be extended southward to the double-deck section of I-93 at the northern Project limits. The crossover between northbound and southbound lanes required at the contraflow lane entrance and exit cannot be incorporated in a double-deck roadway configuration. The contraflow lane begins and terminates, therefore, on the side-by-side segment of I-93 to the north of the Project limits. The only direct physical connection possible is in the AM peak period from the southbound contraflow lane (the left lane of the northbound direction, beyond the Project limits) to the southbound concurrent flow lane (within the Project limits, in the case of the Preferred Alternative). The design of the HOV lane within the Project limits does not present any particular obstacles or constraints to establishing this connection, although the details of this transition need to be developed as part of the continuing design process. In a separate action, MHD has established a process for the coordination of Statewide HOV projects, including those planned for this Project and segments of I-93 to the north of the Project limits.

Northbound. In the northbound direction, physical connections between the Charles River Crossing segment of I-93 and the contraflow lane do not represent a substantive concern, because a northbound HOV lane cannot be accommodated within the Project limits. An issue that could affect the design of the contraflow lane would be the weaving distance required between the general-purpose entrance ramps within the Project limits and the entrance to the contraflow HOV lane. A left-side diverge lane to the HOV entrance must begin at a point that will provide for safe weaving distances from the upstream entrance ramps, which would in effect control the location of the northbound contraflow lane entrance. The overriding constraint, however, will be the need to begin the contraflow lane where the northbound and southbound mainlines are side by side.

Specification of the northbound HOV entry point would be an element of contraflow design. Scheme Z and the Preferred Alternative are compatible with a contraflow lane beginning to the north of the Project limits near Sullivan Square.

Storage Of Barrier Transfer Vehicle. Several additional considerations were identified in the MHD's 1992 *High-Occupancy Vehicle Feasibility Study* that concern coordination between the Charles River Crossing and the proposed contraflow lane to the north on I-93. The first of these relates to the availability of a storage area within the Charles River Crossing for one of two barrier transfer vehicles, which are required to set out the moveable barriers used to separate the contraflow lane from opposing direction general-purpose traffic.

Since the Project is on viaduct north of the Charles River, the siting of a storage area within the mainline or ramp structures is complicated. One possible alternative that warrants further analysis would be a site at grade near the I-93/Rutherford Avenue Service Road and BSG. Several parcels close to the Service Road may be suitable for storage of the barrier transfer vehicle. Access to and from I-93 near the southern entrance/terminus of the contraflow lane is good with the Preferred Alternative, but not with Scheme Z. Unlike the Preferred Alternative, Scheme Z does not provide direct ramp access to this area, but requires the barrier transfer vehicle to use a circuitous surface street route through City Square. For this reason, Scheme Z is not compatible with storage of the vehicle in the Service Road/BSG area.

The principal operational difficulty associated with a site in the Service Road/BSG area is the need to drive the barrier transfer vehicle across three I-93 mainline lanes from the left-sided median to the right-sided southbound exit to the parallel viaduct (connecting to Charlestown, Storrow Drive, and Tobin Bridge). Escort vehicles shadowing the barrier transfer vehicle probably are needed to facilitate this movement.

Contraflow Enforcement Area. Another potential compatibility issue concerns the location of an area to monitor and control use of the proposed contraflow lane. A prime location for this enforcement area would be at the entry to the northbound contraflow lane, which would be to the north of the Project limits, where the northbound and southbound I-93 lanes are side by side. Location of the enforcement area on the upper level of the double-deck section of I-93, to the south of the side-by-side section and within the Project limits, would not be practical. Given such limitations, the design of the Charles River Crossing does not affect the location of a potential contraflow enforcement area.

4.1.6(d) Bus Access To The Haymarket Area Or Alternative Downtown Terminal

Access to the MBTA Haymarket station or a potential bus terminal on the MBTA Green Line parcel to the south of Causeway Street would be via the exit ramp to Nashua Street, for both designs. From Nashua Street to the terminal area, buses would travel to Causeway Street (in the case of the Green Line parcel) or Merrimac/New Sudbury Streets (Haymarket) via Lomasney Way. On the reverse trip outbound from downtown Boston, access to I-93 with both designs would be via the on-ramp at New Sudbury Street, which is readily accessible from either terminal location. At the present time, the MBTA has not determined a definitive routing strategy for buses entering the downtown area from the north. One possibility under consideration would be to have buses continue beyond the Haymarket area along a Congress Street bus corridor. Access to Congress Street would be from Nashua/Merrimac Streets. The Project will continue to coordinate with the MBTA on design issues that may affect MBTA bus operations.

Operating speeds for buses on the viaduct connecting to Nashua Street will be acceptable (generally 27 to 29 mph in the AM and PM peak hours). The distance required to travel via surface streets from the Nashua Street ramp to Haymarket, the MBTA Green Line parcel south of Causway Street, or Congress Street will be short, and travel time via the outbound route from New Sudbury Street to I-93 would be minimal for both designs. The travel time and distance required for access to I-93 north would be substantially greater with Scheme Z, due to the absence of the New Sudbury Street on-ramp. (This Scheme Z impact is described in further detail in Section 4.1.8(a).) Overall, bus connections between I-93 and downtown Boston would require less time with the Preferred Alternative than with Scheme Z.

MHD has evaluated a potential direct ramp connection from the southbound Storrow Drive connector bridge to a bus terminal that could be located on the MBTA Green Line parcel south of Causeway Street. This analysis showed that the ramp connection would not be feasible from the standpoint of design, for the following reasons:

- In both the Preferred Alternative and Scheme Z, the Storrow Drive connector bridge would carry two-way traffic. Buses would need to turn left from the connector to the bus ramp, crossing oncoming northbound traffic. This movement would require signalization on the elevated connector at a point of horizontal curvature and a 5 percent downgrade, in violation of standard design practice.

- There are a number of profile, horizontal space, and structural constraints that in combination would force the ramp into an unacceptable configuration for both designs.

- The visual impact of the elevated ramp across Causeway Street may be perceived as negative.

In summary, construction of the bus ramp would be impractical due to physical constraints.

4.1.7 Parking Facilities

The Project boundaries in the Area North of Causeway Street encompass a total of 2,732 parking spaces, on-street and off-street, public and private (see Figure 4.11 and the Transportation Appendix). The Preferred Alternative generates permanent parking losses totalling 687 spaces. This total is 253 spaces more than the 434 spaces that are lost permanently under Scheme Z.

The locations of permanently lost spaces are identified in Table 4.7. This table shows that the Preferred Alternative results in permanent parking displacements of 183 spaces on public property that allow public access; 138 spaces on public property with restricted access; and 366 spaces on private property. For Scheme Z, the respective numbers are 33, 80, and 321.

Mitigation. The MBTA's 1,300-space North Station parking garage under construction replaces all publicly owned spaces lost on a permanent basis as a result of the Charles River Crossing with either design. Owners of the spaces displaced on private property are compensated for their losses in accordance with MHD policy for this Project. In addition, no net loss of on-street parking spaces, public/private transit loading and staging apaces, and commercial loading spaces will occur. MHD will continue to work with BTD to identify appropriate replacement strategies for these spaces.

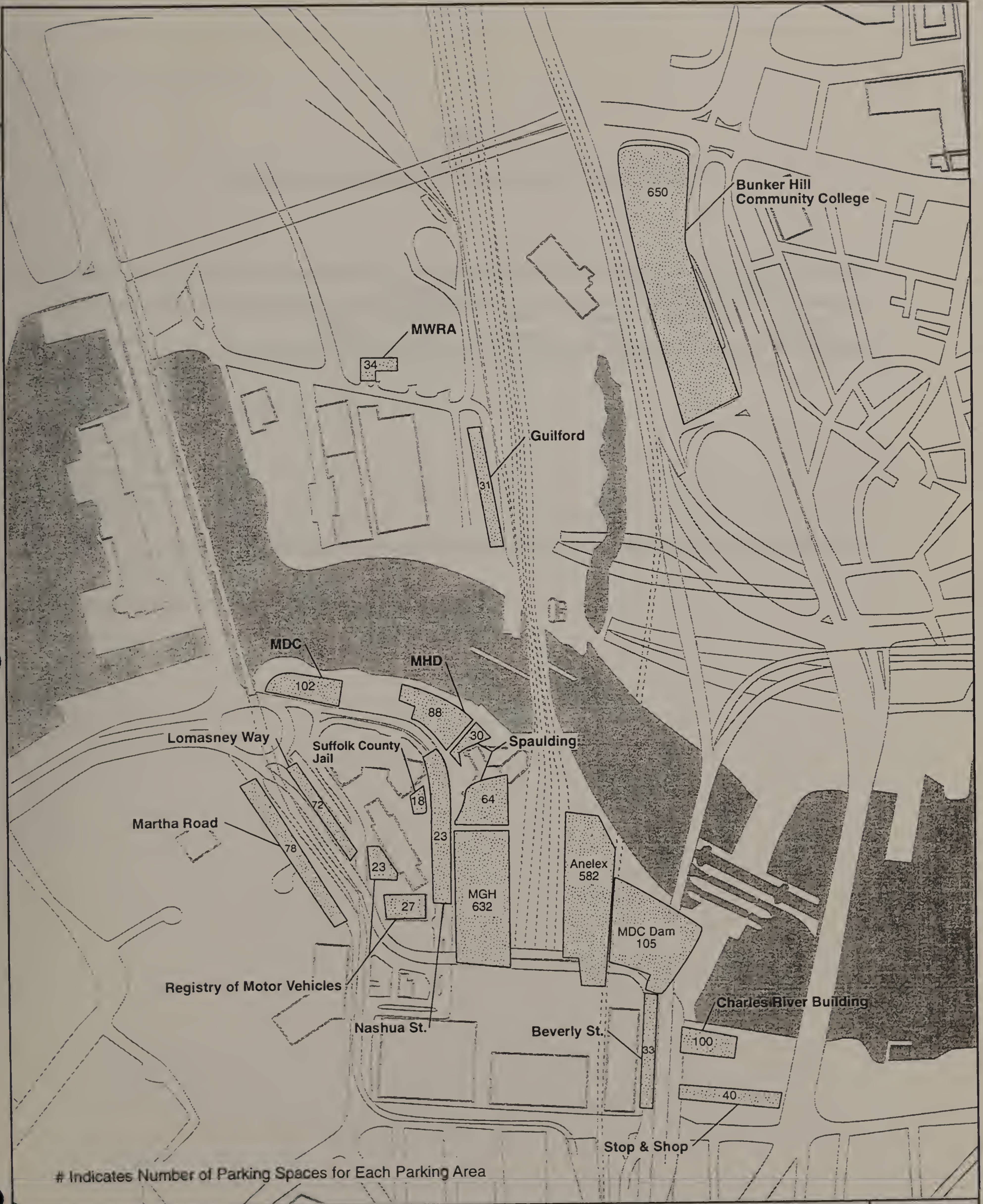
4.1.8 Impacts On Public Transportation

The Charles River Crossing area not only is a key highway corridor but also contains important elements of the regional public transportation network in a variety of modes: commuter rail, transit bus, light rail, and rail rapid transit. It is also the area in which the proposed North Station/South Station rail link tunnel would have its northern portal and its northernmost station, at North Station. Permanent impacts of the two designs on these public transportation facilities are described in this section (see Chapter 5 for a discussion of temporary construction period impacts).

4.1.8(a) Impacts On Existing And Planned Facilities And Operations

Commuter Rail. Neither of the two designs has a permanent impact on commuter railroad facilities or operations.

Bus. A total of five MBTA express and local bus routes and several additional bus routes operated by private companies carry passengers to and from Boston via I-93. Four other MBTA bus routes traverse the Project area, via the North Washington Street bridge. Two of these routes provide local service to Charlestown via Main and Bunker Hill Streets, respectively, terminating at Sullivan Square. A third local bus route to Woodlawn in Chelsea,


650
Bunker Hill Community College
MWRA
34
Guilford
31
MDC
102
MHD
88
30
Spaulding
Lomasney Way
Suffolk County Jail
18
64
72
Martha Road
78
23
23
27
Anelex 582
MGH 632
MDC Dam 105
Registry of Motor Vehicles
Nashua St.
Beverly St.
33
Charles River Building
100
40
Stop & Shop

# Indicates Number of Parking Spaces for Each Parking Area

FIGURE 4.11

Existing Parking Facilities: Area North Of Causeway Street

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 100 200 300 400 500 FEET

Table 4.7

PERMANENT PARKING DISPLACEMENTS BY DESIGN

Parcel	Scheme Z			Preferred Alternative		
No. Name	Public Access	Restricted Access	Private Property	Public Access	Restricted Access	Private Property
1 MDC: Charles River Dam Lot	n/a	30	n/a	0	30	0
2 Anelex (back)	n/a	n/a	290	0	0	335
3 Registry of Motor Vehicles (side)	72	0	0	0	27	0
4 Registry of Motor Vehicles (back)	78	0	0	0	23	0
5 Lomansey Way	0	0	31	72	0	0
6 Martha Road	33	0	0	78	0	0
7 Guilford: B&M Yards	n/a	n/a	n/a	0	0	31
8 Beverly Street	n/a	n/a	n/a	33	0	0
9 Bunker Hill Comm. College Lot	n/a	n/a	n/a	n/a	58	0
Total-	183	30	321	183	138	366

Source: Bechtel/Parsons Brinckerhoff

and an express bus route originating in Central Square, Lynn, travel over the Tobin Bridge.

Buses travelling to downtown Boston via I-93 are proposed to use the Nashua Street exit via the Storrow Drive connector bridge. The viaduct operates with speeds in the range of 27 to 29 mph in 2010. On the outbound trip from downtown, buses will use the I-93 northbound on-ramp at New Sudbury Street, in the case of the Preferred Alternative. The on-ramp connects to a viaduct paralleling the I-93 mainline. The 2010 speeds on the I-93 viaduct are approximately 30 mph in both the AM and PM peak hours.

With Scheme Z, however, access to I-93 north from the Haymarket area or a potential terminal on the MBTA Green Line parcel to the south of Causeway Street is circuitous. The most likely access points are at Leverett Circle in downtown Boston, or Assembly Square, to the north of the Project limits. Assembly Square access would occur via Rutherford Avenue. Northbound bus access to I-93, therefore, is substantially improved with the Preferred Alternative compared to Scheme Z.

Light Rail. The Lechmere Green Line currently is routed through the Project area on a viaduct extending from Lechmere to the North Station transit station via O'Brien Highway, the old Charles River Dam, Martha Road, and Causeway Street. A new routing is under construction that will take the line from a portal adjacent to Martha Road into a tunnel behind the existing North Station railroad terminal to a new underground "superstation." The superstation will be in the same location as the existing North Station subway station and will serve both the Orange and Green Lines. Planning for the Preferred Alternative in this area has taken Green Line tunnel and superstation plans into account. As a result, the Project will not interfere with MBTA tunnel construction or Green Line operations.

Rail Rapid Transit. The MBTA's Orange Line rail rapid transit facilities, including two stations (Community College and Sullivan Square), occupy the surface beneath the existing I-93 viaduct from the Charles River to Sullivan Square. The tunnels and viaducts of the Project will be designed to avoid conflicts or disruptions of Orange Line service. A pending transit initiative, a circumferential transit line concept, has proposed that the line connect to the Community College station. However, lack of specific details concerning the "transitway" does not enable a determination of the impact to the transitway resulting from the Project.

Boston Helipad. The Chapter 91 license for the Suffolk County Jail and relocation of Nashua Street requires removal of the helipad on Nashua Street by December 31, 1994. Any alteration of the projected schedule for removal of the helipad that may be requested by the Federal Aviation Administration is subject to coordination with the MDC and is not a responsibility of the Massachusetts Highway Department or the Central Artery/Tunnel Project.

4.1.8(b) North Station/South Station Rail Link

Concurrent with planning for the Central Artery/Tunnel Project, the EOTC established an independent task force to explore the technical feasibility of connecting the commuter and intercity passenger (AMTRAK) railroad lines north and south of Boston through a tunnel. The tunnel would link two separate railroad operations that currently terminate at North and South Stations, respectively.

The feasibility study prepared by the Central Artery Rail Link Task Force (CARLTF) identified two possible alignments within the Central Artery highway corridor. The two alignments were identical from State Street northward while differing both horizontally and vertically south of State Street. The initial alignment followed a "high" profile under Atlantic Avenue with the southerly portal near Kneeland Street. The task force dismissed this alignment from further consideration due to unresolvable conflicts with the design of the highway Project. The alignment that was recommended by the task force follows a "deep" profile route under the South Station headhouse and the South Station Transportation Center, presently under construction. In this alignment, the rail tunnel would diverge under the existing South Station railroad yard with one branch continuing along the Massachusetts Turnpike right-of-way through Back Bay Station and points west. The second branch would extend southward to service the Old Colony Line currently being rebuilt by the MBTA.

The various tunnel construction techniques recommended in the CARLTF report would allow the rail link to use space within the Central Artery transportation corridor without conflicting with the highway design and construction schedules. There would be several instances where the two projects will directly interface, and the rail link design will take advantage of the highway design and construction techniques available to it. The designs of both projects will be developed such that neither design will preclude the existence of the other.

In the area of the Charles River Crossing, as proposed, the rail link will pass along the easterly side of the North Station/new Boston Garden complex now under construction and cross under the Charles River between the existing railroad bascule bridge and the proposed mainline highway bridge. In order to best accommodate each other, the rail link's alignment varies with both of the highway river crossing designs included in this FSEIS/R. In both alternatives, the rail link tunnel passes beneath the proposed highway viaducts connecting the Central Artery with Route 1 and I-93, surfacing to grade in the existing Somerville railroad yards north of the Gilmore Bridge. Consequently, the rail link can be designed to be equally compatible with the Preferred Alternative or Scheme Z.

4.1.9 Pedestrian And Bicycle Circulation

Planned Improvements. The Project will create the opportunity for extending the Charles River Esplanade/green belt system from the old Charles River Dam to Boston Harbor. Plans have been developed by a variety of State and local agencies with jurisdiction in the area that, collectively, would form a comprehensive and coordinated complex of riverside parklands on both sides of the Charles River. The features include continuous bikeways and pedestrian pathways serving both commuters and recreational users (see Figure 4.12). Proposed lateral connecting pathways into adjacent neighborhoods and to major destinations augment the main riverside paths.

The present conceptual design of the parklands and pedestrian/bicycle circulation system within and adjacent to the Project area bordering the Charles River is shown in Figure 4.12. Illustrated is a continuous green belt and pathway system on both sides of the Charles River. On the north side, the Esplanade extension begins at the old Charles River Dam (O'Brien Highway) and extends eastward around North Point to the railroad bridges.

Bicycle and pedestrian pathways moving through the north side green belt would merge for a bridge crossing over the railroad tracks. From that point, the green belt and pathways would continue along the shoreline, and pass under the Charles River bridge crossing to a connection with the Paul Revere Landing Park North adjacent to the new Charles River Dam. From this point, pedestrians and cyclists can go under the North Washington Street bridge and connect to a proposed Harborwalk path that accesses the Navy Yard historical site operated by the National Park Service.

On the river's south side, the Esplanade green belt would begin at Leverett Circle and the MBTA Science Park station where the existing system ends, and follow the south shore of the river to the railroad bridges and tracks coming out of North Station. As on the north side, a combined bicycle/pedestrian bridge would span over the railroad tracks. The green belt would extend on the far side of the tracks and continue via the grounds of the new Charles River Dam and a redeveloped Lovejoy Wharf to the North Washington Street bridge where it would meet the Harborwalk green belt around the Boston Harbor waterfront. A more detailed illustration of the greenbelt-bikeway/pathway system may be found in Figure 4.15 showing the MDC parkland master plan.

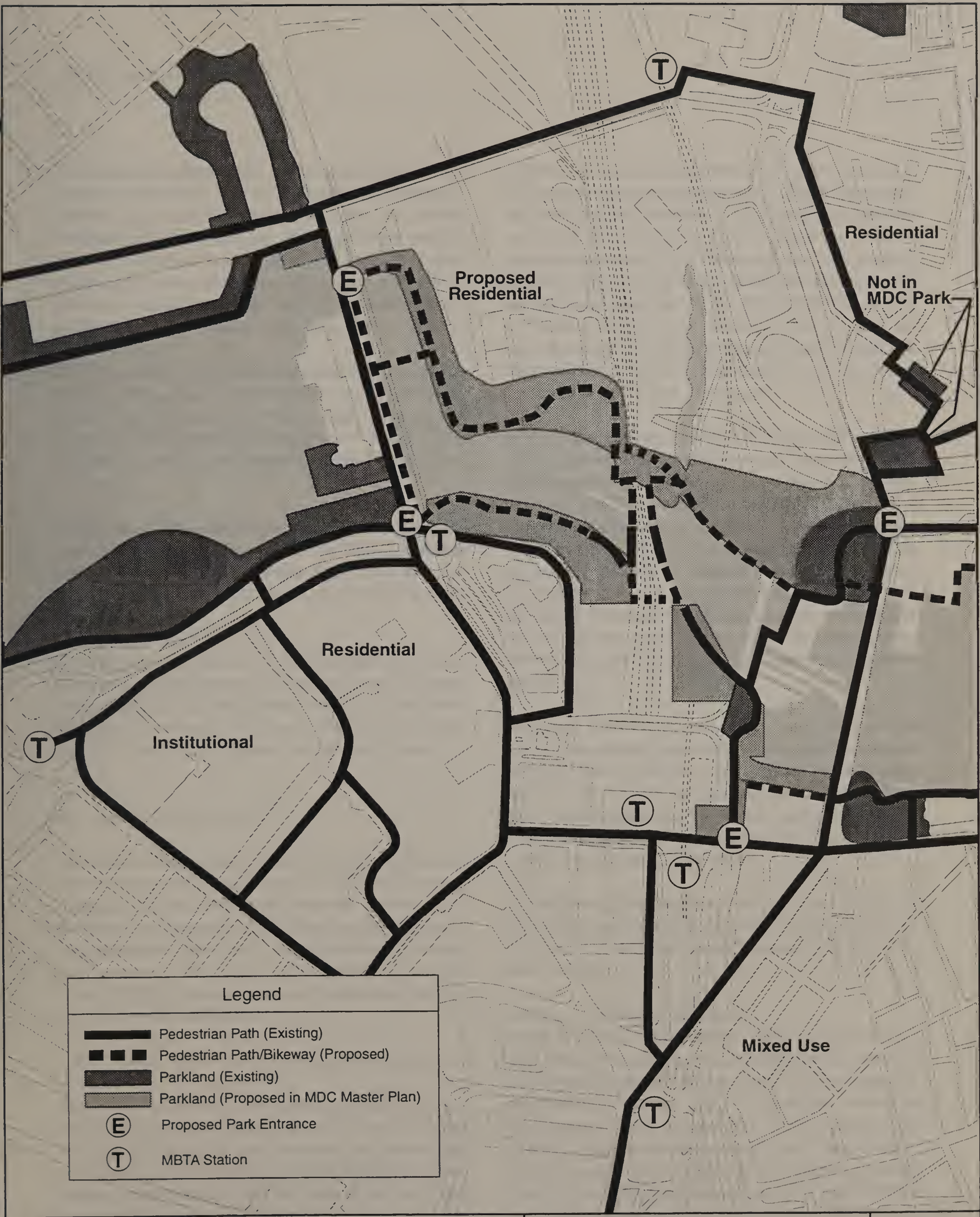
The two designs for the Charles River Crossing have varying impacts on the proposed green belt-bikeway/pathway system described above. Neither precludes any element of the proposed plans from being implemented.

4.1.10 Mitigation Measures

The following mitigation measures appear in the above Transportation section:

Rutherford Avenue Corridor Study. The Preferred Alternative design shows the relocation of the C-L off-ramp from its location at Bunker Hill Community College (as described in the 1993 DSEIS/R) to Cambridge Street, west of Sullivan Square and along Rutherford Avenue. In light of this design change, MHD commits to fund an arterial study of Rutherford Avenue from City Square to and including Sullivan Square. This study will be conducted in cooperation with the City of Boston Transportation Department, and will include but not be limited to an evaluation of all planned transportation projects affecting the study area including the proposed Medford Street Bypass Road, and other planned improvements to the Rutherford Avenue, Sullivan Square viaduct and tunnel structures. Upon completion of the study MHD will make all efforts to prioritize and advance the implementation of appropriate capital improvements.

Replacement Parking. The MBTA's 1,300-space


Residential
Proposed Residential
Not in MDC Park
Residential
Institutional
Mixed Use
E
T
Legend
Pedestrian Path (Existing)
Pedestrian Path/Bikeway (Proposed)
Parkland (Existing)
Parkland (Proposed in MDC Master Plan)
E Proposed Park Entrance
T MBTA Station

FIGURE

4.12 Pedestrian Pathways/Bikeways

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 800 FEET

North Station parking garage replaces all publicly owned spaces permanently lost as a result of the Project. Owners of displaced private spaces are to be compensated for their loss. No net loss to on-street parking spaces, public/private transit boarding and staging spaces, and commercial loading spaces will occur. MHD will continue to work with BTD to identify appropriate replacement strategies for these spaces.

HOV Facilities. MHD will implement a northward extension of the existing southbound HOV lane on I-93 north of the Charles River as a short-range measure. A contraflow HOV lane northward toward Route 128 is currently proposed upon completion of the Charles River Crossing.

Pedestrian Paths And Bikeways. Pedestrian paths and bikeways will be installed as part of the MDC's Parkland Master Plan for the Lower Charles River Basin designed to offset the environmental effects of the Charles River Crossing.

Geometric Modifications. Appropriate operational and/or geometric modifications will be made to the following intersections to offset degradation to LOS resulting from the Project: Leverett Circle, New Sudbury/Cross Streets, Charles Circle, Keany Square, and Sullivan Square.

4.2 LAND USE IMPACTS

This section compares impacts of the Preferred Alternative with those of Scheme Z, the 1991 FSEIS/R Proposed Action in the Area North of Causeway Street, in the following five subject areas: land use, social conditions, and farmlands; open space (except parklands, which are discussed in the Section 4(f) Evaluation at the end of the FSEIS/R); right-of-way and relocations; economics; and joint developments.

4.2.1 Land Use, Social, And Farmland Impacts

Neither of the Charles River Crossing designs (the Preferred Alternative nor Scheme Z; see Figures 4.13 and 4.14) has a long-term impact on existing or planned land use patterns. Both, however, affect development opportunities of parcels of land on both banks of the river. Joint development impacts are discussed in Section 4.2.5. Social impacts consist primarily of impacts to current and planned open space, as neither of the alignments divides existing residential communities. Both of the designs affect existing and planned open space. These impacts are discussed in detail in Section 4.2.2, Open Space Impacts, and in the Section 4(f) Evaluation. There are no farmland impacts; none of the Project area has been in use as farmland for several decades. Regional impacts are the same as those described in the 1991 FSEIS/R, and are not directly related to any Charles River Crossing design, but rather to the Central Artery/Tunnel Project as a whole. See Chapter 5.4 for a discussion of temporary, construction period land use impacts.

North of the river, the Preferred Alternative affects BSG operations but improves its access, and improves the development potential of BRA-owned parcels on Rutherford Avenue. The Preferred Alternative requires changes to the planned perimeter road at the North Point development area; however, it has substantially less impact on the area than Scheme Z. South of the river, the Preferred Alternative complicates the development potential of both the MBTA and MGH development parcels and requires the acquisition and demolition of the Spaulding Rehabilitation Hospital and the Minot Station steam generating plant.

Impacts of Scheme Z are primarily on open space, which is adversely affected both north and south of the river. In addition, north of the river, the scale of the loop ramps may adversely affect the development potential of the North Point development site in East Cambridge. Scheme Z has virtually no impacts on existing buildings or development parcels south of the river.

The following discusses long-term land use impacts of both the Preferred Alternative and Scheme Z. Figures 4.13 and 4.14 show how the two designs affect the parcels described.

4.2.1(a) Preferred Alternative

North Of The Charles River. Highway elements for the Preferred Alternative are reduced from those described for Scheme Z, and are approximately 450 feet from the residential community east of Rutherford Avenue in Charlestown. The loop ramps are within approximately 24 feet of proposed buildings in the North Point development area and require changes to the planned perimeter road on the east side of the development. There are three loop ramps merging into two loop ramps in this area.

BSG has to reconfigure some of its operations, but the mass of piers and overhead structure is less than with Scheme Z. BSG trucks have greatly improved access with the Preferred Alternative compared to both existing conditions and with Scheme Z, directly between Rutherford Avenue and the regional highway system because of a new at-grade signalized intersection. As a result, concrete trucks headed to and from the north no longer need to use local streets in City Square, thus benefiting the community. Trucks continue to use Rutherford Avenue for a short distance to access I-93 southbound.

The triangular parcel bounded by Rutherford Avenue on the east, the I-93 viaduct on the west, and the new local access road perpendicular to Rutherford Avenue on the north is approximately 80,000 square feet larger than the area created by Scheme Z. This additional space is behind the CANA parcel referred to as the Rutherford Avenue buffer zone or “teardrop” parcel. An electrical substation to service the Project, and an MHD satellite maintenance facility, will be located behind the teardrop parcel (see Subsection 4.2.1(c)). The teardrop parcel, under the original CANA project specifications, is to be a landscaped “infield,” fenced off from the highway for pedestrian safety reasons. Some of the material excavated from City Square was placed there and is typical of urban fill found throughout Boston. This fill has been deemed inappropriate for recreational use. As part of the subsequent Chapter 91 license for the CANA temporary loop ramps, this area will be further contoured and landscaped. If deemed appropriate for active public use, the site will be remediated in conformance with DEP requirements.

The BRA-owned parcels north of the teardrop parcel and across from the new local access road to BSG and Rutherford Avenue could be expanded with the Preferred Alternative because Ramp T-N is farther west; this expansion is not possible with Scheme Z.

As with Scheme Z, there are no impacts to Bunker Hill Community College since the I-93 off-ramp (through the College’s athletic fields in the 1993 DSEIS/R) has been shifted farther north, to Cambridge Street near Sullivan Square. The realigned ramp will create a new intersection with Cambridge Street.

South Of The Charles River. The Preferred Alternative affects several development parcels (see Section 4.2.5, Joint Development Impacts). At the MGH development parcel, Ramps N-S and S-N are north of the existing viaduct and slightly reduce the size of the parcel. Tunnel Ramp L-CS is underneath the parcel, while Ramp CN-L rises from tunnel to boat section on the parcel. Ramp CN surfaces on the east side of Nashua Street. A 120-foot by 60-foot subgrade ventilation building is constructed on the south edge of the MGH parcel. These impacts complicate the development potential of the site. Development opportunities on the site and expanded parkland development are possible.

Ramps N-S and S-N traverse the southerly portion of the MBTA commuter railroad parcel planned for an air rights garage, removing approximately 49 percent of the garage area and restricting the design of internal circulation. Access to the garage from Nashua Street is impeded somewhat more than in Scheme Z. Tunnel Ramps LC-S, CN-S, and CN-L under the MBTA commuter railroad parcel require modification to foundations for the air rights garage.

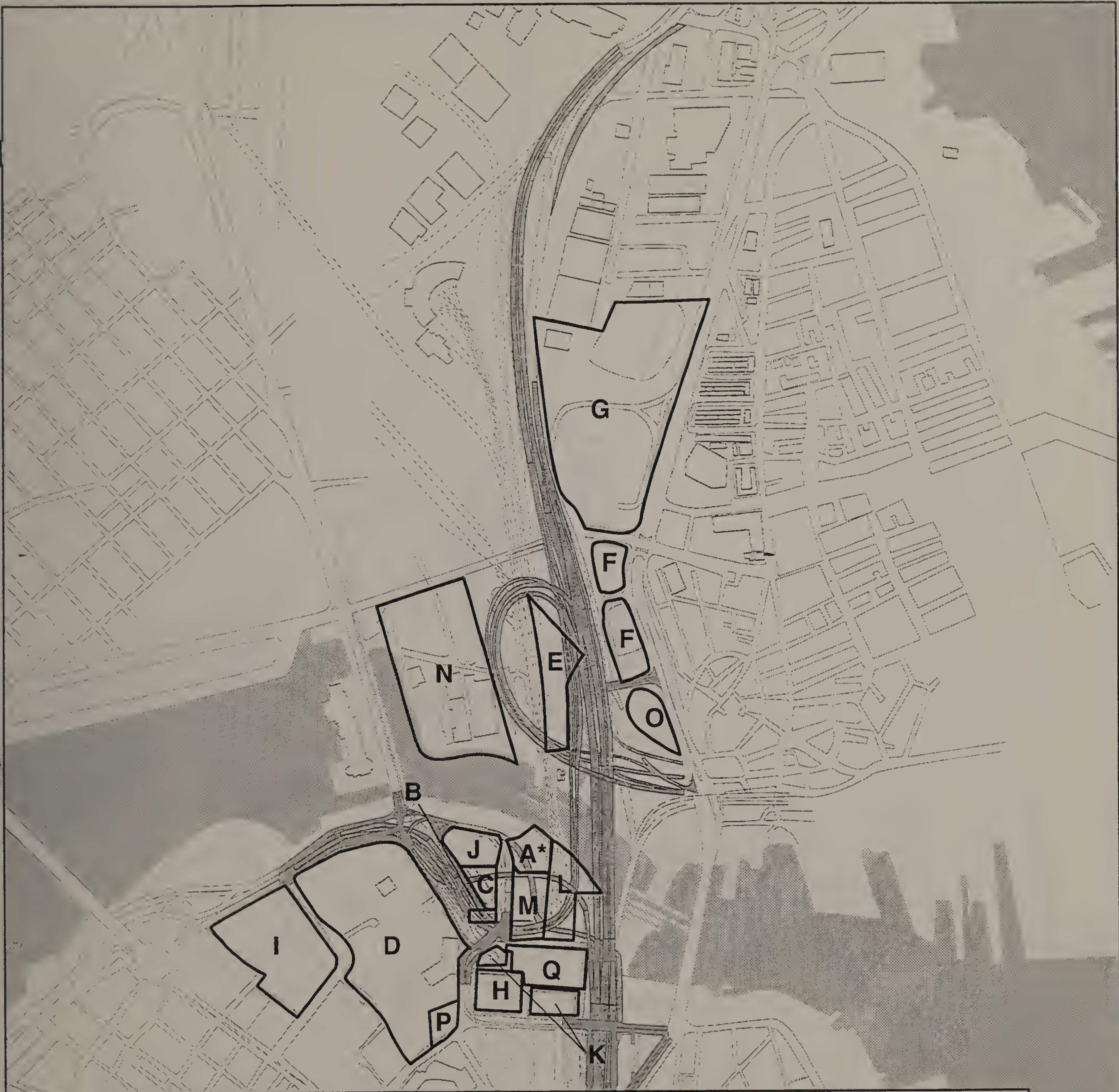
The widening of Storrow Drive eastbound to Leverett Circle results in a narrower sidewalk area.

Acquisition and demolition of Spaulding Rehabilitation Hospital is required by the new off-ramp to Nashua Street. Following Project construction, the remaining portion of the parcel could be developed for other long-term uses, such as parkland (at least 100 feet in width) on the north half abutting the proposed Nashua Street Park, and other development on the south half between the new boat section and the MGH parcel.

The Registry building requires underpinning. The rear egress and loading area of the building is affected by Ramps N-L and N-S. The Preferred Alternative does not affect the use of the building.

Ramps N-S and N-S require acquisition and demolition of the Boston Thermal Energy Corporation’s Minot Station steam generating plant, leaving a small residual open space at the pedestrian crossing opposite the new Boston Garden Building A site. Removal of the existing I-93/ Storrow Drive viaduct provides some small additional ground-level space at the north end of the new Boston Garden Building A parcel.

Lovejoy Wharf is developed for open space and a water transportation dock with vehicular and pedestrian access provided.



Existing	Proposed	Under Construction
A.* Spaulding Rehabilitation Hospital B. Boston Thermal Steam Plant C. Massachusetts Registry Building D. Charles River Park Apartments E Boston Sand & Gravel F. BRA-owned Parcels G. Bunker Hill Community College H. O'Neill Federal Office Building I. MGH Campus J. Suffolk County Jail	K. Office L. MBTA Air-Rights Garage M. MGH Development Parcel N. North Point Development O. CANA Landscaped Parcel P. Lowell Square Apartments A.* Spaulding Site: North Portion: Parkland South Portion: Development	Q. New Boston Garden (above grade) MBTA Garage (below grade)

FIGURE

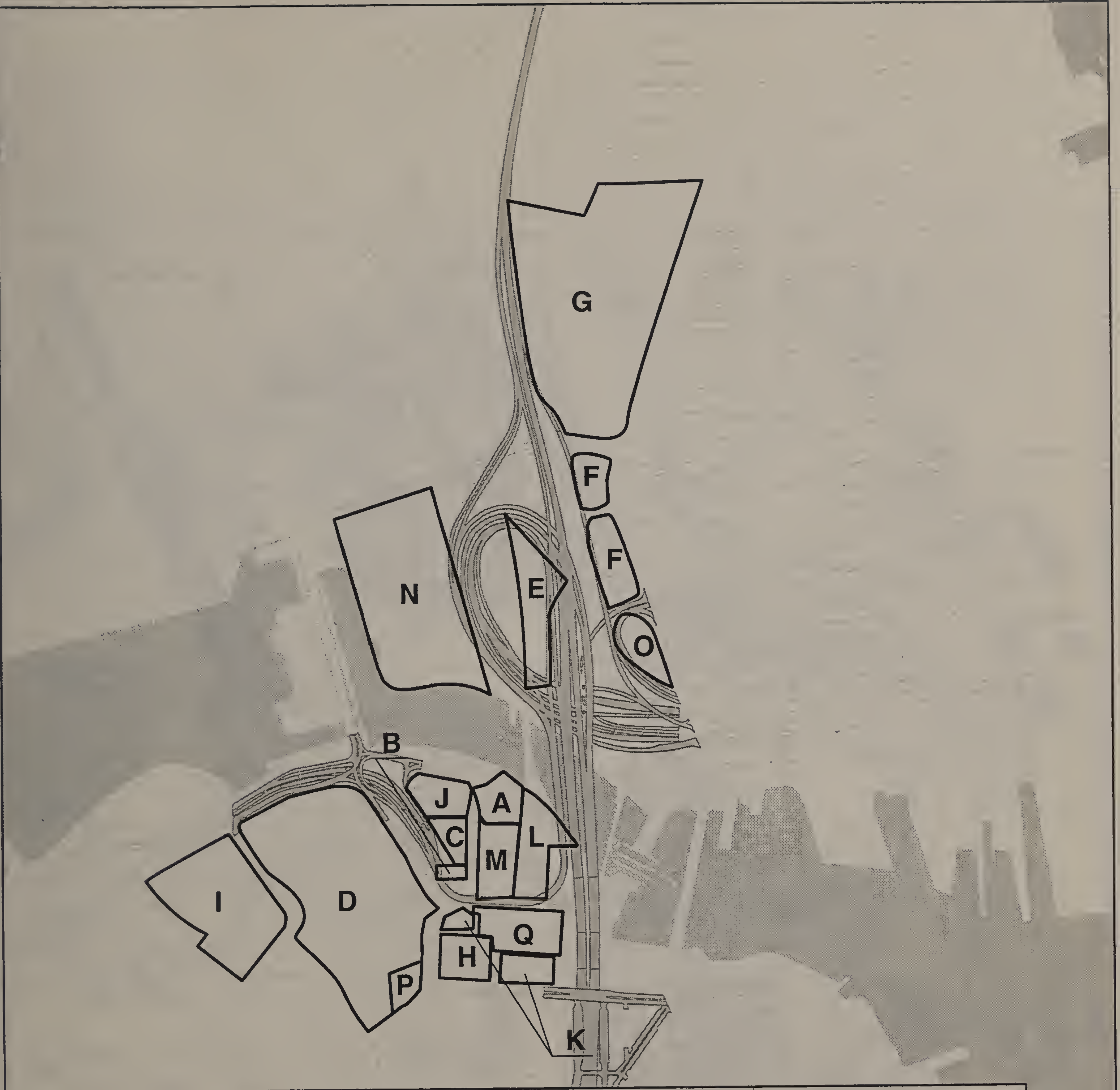
4.13

Affected Major Land Use Features: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET



Existing	Proposed	Under Construction
A. Spaulding Rehabilitation Hospital	**K.** Office	**Q.** New Boston Garden (above grade) MBTA Garage (below grade)
B. Boston Thermal Steam Plant	**L.** MBTA Air-Rights Garage	
C. Massachusetts Registry Building	**M.** MGH Development Parcel	
D. Charles River Park Apartments	**N.** North Point Development	
E Boston Sand & Gravel	**O.** CANA Landscaped Parcel	
F. BRA-owned Parcels	**P.** Lowell Square Apartments	
G. Bunker Hill Community College		
H. O'Neill Federal Office Building		
I. MGH Campus		
J. Suffolk County Jail		

FIGURE

4.14

Affected Major Land Use Features: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

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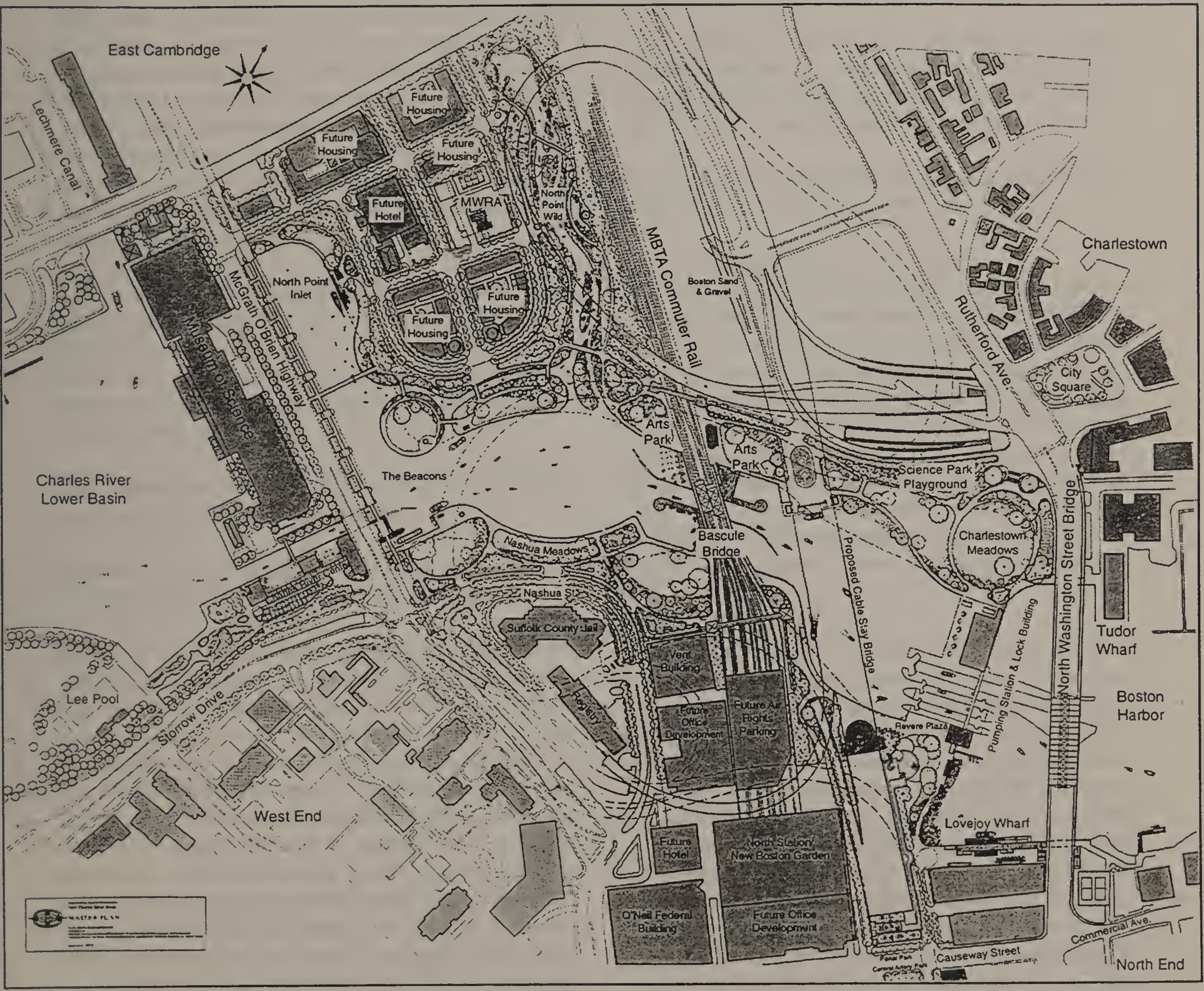

East Cambridge
Lechmere Canal
Future Housing
Future Housing
Future Housing
Future Hotel
MWRA
North Point Wild
MBTA Commuter Rail
Boston Sand & Gravel
Charlestown
Rutherford Ave.
North Point Inlet
Future Housing
Future Housing
McGrath O'Brien Highway
Museum of Science
City Square
Charles River Lower Basin
The Beacons
Arts Park
Arts Park
Science Park Playground
Charlestown Meadows
Bascule Bridge
Nashua Meadows
Nashua St.
Suffolk County Jail
Proposed Cable Stay Bridge
North Washington Street Bridge
Tudor Wharf
Boston Harbor
Pumping Station & Lock Building
Vent Building
Future Office Development
Future Air Rights Parking
Revere Plaza
Lee Pool
Storrow Drive
West End
Lovejoy Wharf
Future Hotel
North Station New Boston Garden
O'Neil Federal Building
Future Office Development
Causeway Street
Commercial Ave.
North End
MASTER PLAN

Source: Metropolitan District Commission, August 1993 Draft Parkland Master Plan

Note: MDC Plan was prepared based on Alternative 8.1D Mod 5 featured in MHD's September 1992
Notice of Project Change. Modification to accommodate the Preferred Alternative will be incorporated.

FIGURE

4.15

1993 MDC Draft Parkland Master Plan
For New Charles River Basin

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY (I-93)/TUNNEL (I-90) PROJECT

4.2.1(b) Scheme Z

North Of The Charles River. The many viaducts and loop ramps of Scheme Z affect open space along the river's edge (see Section 4.2.2), and the number, height, and location of the loop ramps may negatively affect the development potential of this area. In addition, the loop ramps occupy approximately 1 acre of the proposed North Point development site in East Cambridge. The outer loop ramps are so close to the river's edge that they adversely affect viability of proposed future parkland beneath and next to them.

CANA Ramp T-N, connecting to I-93 northbound, is within approximately 390 feet of the residential community in Charlestown to the east of Rutherford Avenue. BSG has to reconfigure its sand and gravel operations and access because of the viaducts and ramps located within its property.

The Rutherford Avenue teardrop parcel is treated the same under the Preferred Alternative.

Scheme Z will have no effect on the BRA-owned parcels west of Rutherford Avenue and north of the access road.

South Of The Charles River. Impacts of Scheme Z are primarily on open space, particularly at Paul Revere Landing Park South, because the Charles River bridges shadow most of the park and the design displaces part of it for the bridge abutment. Scheme Z has no long-term impacts on the MGH development parcel (currently used for surface parking) along the east side of Nashua Street, as the viaduct connecting I-93 to Storrow Drive is in approximately the same position as the existing viaduct it will replace. Spaulding Rehabilitation Hospital is not affected, although the area around it is changed by future open space and joint development opportunities. Similarly, Scheme Z does not affect the MBTA's air rights garage parcel over the commuter railroad platforms and tracks.

The use of the Registry building is not affected, except the size of the parcel is reduced on the west side, requiring a minor change in access to the rear of the building.

There are no impacts on the Boston Thermal facility or the new Boston Garden development (the Building A parcel).

The widening of Storrow Drive eastbound to Leverett Circle results in a narrower landscaped area in that location (approximately a 10,000-square-foot reduction).

Lovejoy Wharf is developed for open space and a water transportation dock as a construction period mitigation measure identified in the 1991 FSEIS/R, with vehicular and pedestrian access provided to Causeway Street.

Unlike the Preferred Alternative, there is no ventilation building on the south bank of the river.

4.2.1(c) Project Ancillary Facilities

The October 1993 MEPA Certificate directed MHD to site the ancillary facilities as described in the 1993 DSEIS/R. In addition to the required ventilation building for the Preferred Alternative on the south edge of the MGH parcel, and an electrical substation behind the teardrop parcel between Rutherford Avenue and the Project, MHD needs other ancillary Project facilities in the Area North of Causeway Street. These facilities are briefly described below. The three MHD facilities to service and support the highway system and its environs are a maintenance facility, an emergency station, and an emergency platform.

- MHD Satellite Maintenance Facility: This facility requires approximately 1.25 acres. Its purpose is to accommodate personnel and maintenance equipment in the area on a 24-hour basis. For purposes of this FSEIS/R the satellite maintence facility will be located behind the teardrop parcel between the Project and Rutherford Avenue. The parcel will be expanded to form a rectangular parcel, contoured and landscaped to provide a buffer between the Charlestown community and the Project structure and facilities. Investigations have been initiated to determine if it could be incorporated into the site of another public maintenance facility north of the Project area. This study will be coordinated with Charlestown, Cambridge, and Somerville.

- MHD Emergency Station: The purpose of this facility is to accommodate emergency vehicles and personnel to respond to peak-hour traffic incidents in the area. It will operate on a 24-hour basis and will be located within the underground ventilation building on the MGH parcel or in the immediate vicinity.

- MHD Emergency Platforms: Two platforms, approximately 250 square feet in size, for two vehicle parking spaces are needed to accommodate emergency vehicles and personnel to respond to peak hour traffic incidents in the area. They will be so located to meet critical response times. Since there are no environmental impacts associated with the platforms, their exact locations are not an issue for this FSEIS/R. Their locations will be identified during the subsequent design process.

In addition to these above ancillary Project facilities, MHD has agreed previously to relocate the existing MDC Central Services Facility in the North Point area to another location near but north of the Charles River. This facility requires approximately 3.5 acres. Its purpose is administration, warehousing, and vehicle repair. It will operate on a 24-hour basis, and will be located near the MDC parkland and roadways. Any required environmental documentation for this facility will be coordinated with the MDC.

4.2.1(d) Mitigation Measures

Mitigation measures for open space and parkland impacts are discussed in Chapter 6 and the Final Section 4(f) Evaluation. Mitigation measures for impacts to development parcels are discussed in Section 4.2.5, Joint Development.

4.2.2 Open Space Impacts

Planning for the Charles River Crossing since the inception of the Central Artery/Tunnel Project has focused attention on the open space development potential of the area of the Charles River between the Museum of Science and the North Washington Street bridge. Although historically dominated by transportation and industrial uses, this area has in recent years been the subject of extensive planning. The MDC has acquired new parkland parcels in this area, which it plans to develop with the goal of extending the MDC Charles River regional park system from the existing Esplanade to Boston Harbor (see Figure 4.15). Projected land ownership responsibilities are shown in Figure 4.16. MHD supports this goal, and has undertaken thorough evaluation of the Charles River Crossing design, resulting in a comprehensive mitigation program for the Preferred Alternative which can assist in achievement of this goal (see Chapter 6 for the New Charles River Basin Mitigation Program).

The Final Section 4(f) Evaluation at the end of this FSEIS/R provides detailed analysis of the impacts of the Preferred Alternative and the three other designs discussed in the 1993 DSEIS/R on designated parkland parcels within this area. In addition, the Section 4(f) Evaluation and Chapter 6 specifically describe the status of MDC master planning and the proposed parkland mitigation program (see Figure 4.17). This section focuses principally on potential impacts to open space and existing or future pedestrian corridors along the river which are not designated 4(f) parklands.

4.2.2(a) Long-Term Impacts

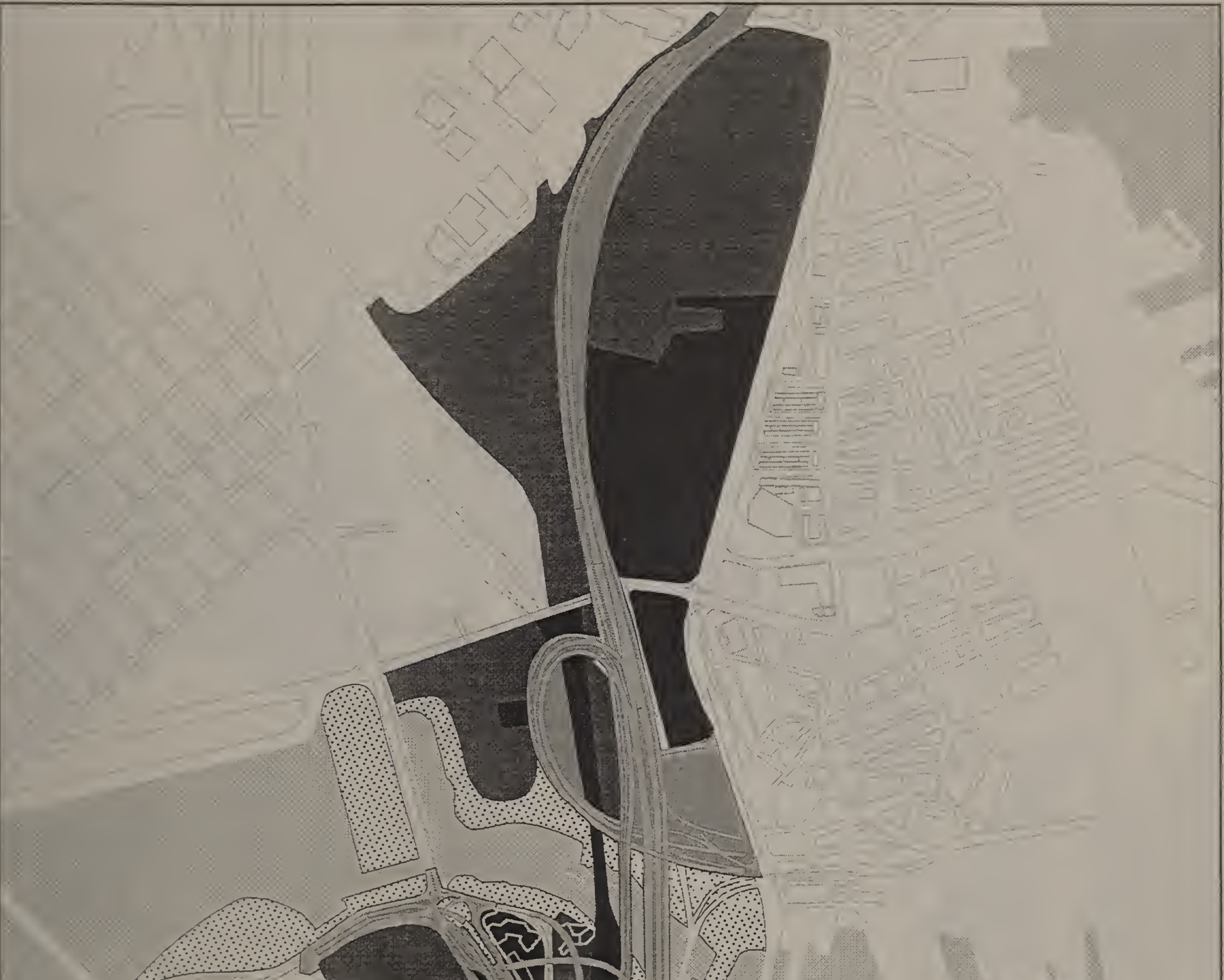
North Point.

Affected Environment: The North Point area stretches from its entrance on O'Brien Highway opposite the Museum of Science garage south along the inlet of the Charles River and east along the riverbank to the MBTA railroad crossing. It includes the MDC Central Services Facility (the former GSA parcel) which is addressed in the Section 4(f) Evaluation. Housing/parking garage development is planned by private developers consistent with policies of the City of Cambridge. The riverside portion of the North Point area is a potential independent link in a continuous path system planned by the MDC to connect upstream parkland to the Charlestown Navy Yard waterfront. The North Point area is planned for passive uses enjoying views of the river.

Impacts: The Preferred Alternative has three ramps merging to a pair of side-by-side loop ramps 35 to 40 feet high with common profiles and simple structures a minimum of 120 feet from the Charles River; visual impact is substantially less than Scheme Z. Noise is reduced somewhat due to an approximate 50 percent reduction in daily traffic volumes with the Preferred Alternative (90,000) compared with Scheme Z (184,000). The area next to the railroad tracks is usable as a landscaped open space area.

Scheme Z results in visual and noise impacts in this area due to its six densely nested loop ramps rising to 105 feet in height and passing adjacent to the Charles River. Much of the area next to the railroad tracks would be unusable due to the loop ramps and their piers. There is also a substantial increase in noise, which would adversely affect the use of open space in this area.

In the Preferred Alternative, a pedestrian walking downriver in this area sees a loop ramp or pair of ramps


Legend
MHD Ownership
Public Agency/ Authority Ownership
Private Ownership
MDC Ownership

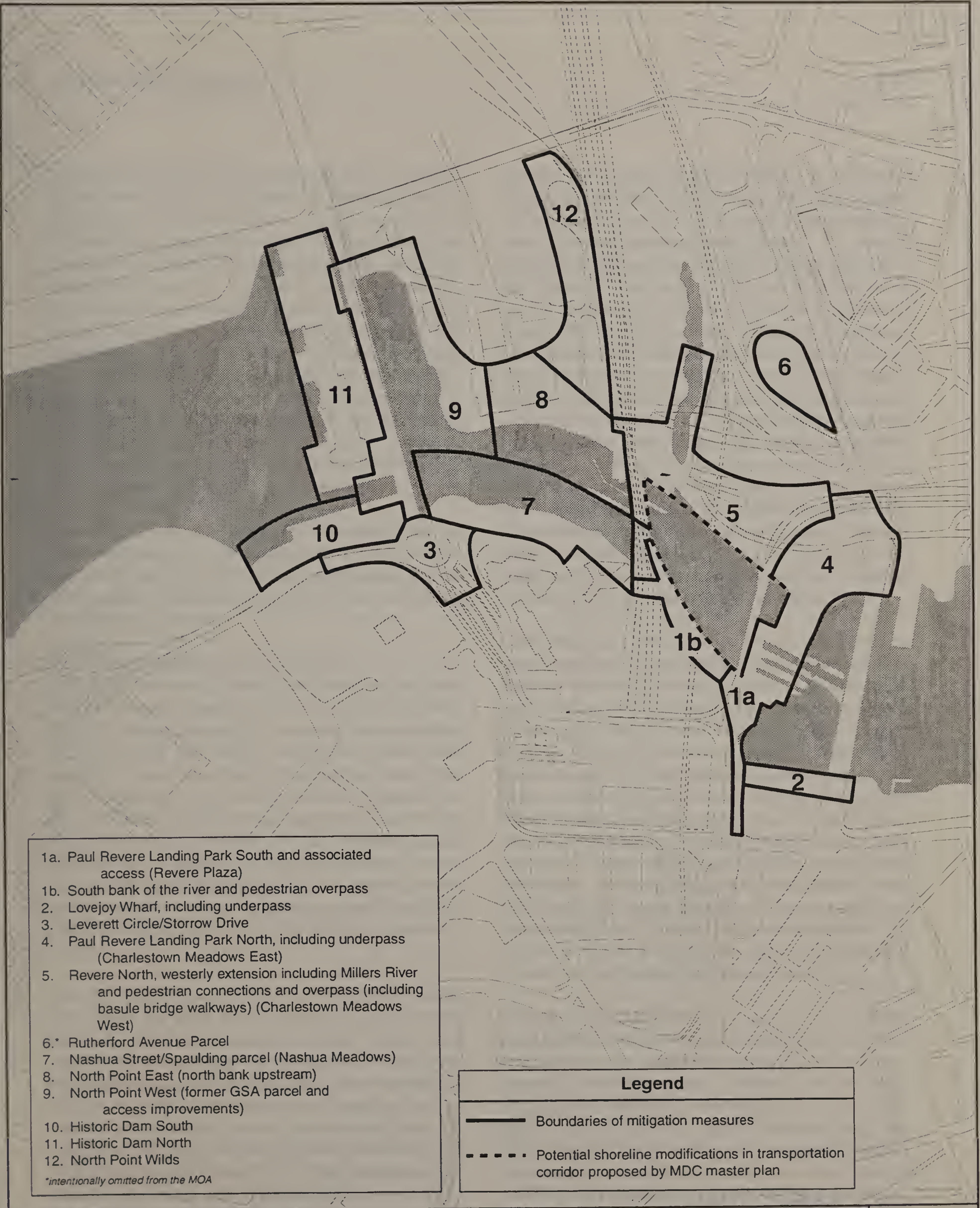
FIGURE

4.16 Projected Land Ownership

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET



1a. Paul Revere Landing Park South and associated access (Revere Plaza)
1b. South bank of the river and pedestrian overpass
2. Lovejoy Wharf, including underpass
3. Leverett Circle/Storrow Drive
4. Paul Revere Landing Park North, including underpass (Charlestown Meadows East)
5. Revere North, westerly extension including Millers River and pedestrian connections and overpass (including basule bridge walkways) (Charlestown Meadows West)
6.* Rutherford Avenue Parcel
7. Nashua Street/Spaulding parcel (Nashua Meadows)
8. North Point East (north bank upstream)
9. North Point West (former GSA parcel and access improvements)
10. Historic Dam South
11. Historic Dam North
12. North Point Wilds

*intentionally omitted from the MOA

Legend

—— Boundaries of mitigation measures

- - - - Potential shoreline modifications in transportation corridor proposed by MDC master plan

FIGURE 4.17 Location of Mitigation Measures

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

set well back from the river, permitting ample landscaping of the riverbank and separation of pedestrian and bicycle paths. Ramp architecture is simpler than Scheme Z's multilevel nested loop ramps. Views along the riverbank are free of the overhead viaduct structures which extend nearly to the river in Scheme Z, and farther downstream one sees bridges of aesthetically improved design (two bridges with similar profiles and with fewer bridge piers than in Scheme Z). Views overall are more open and free of columns, which are densely clustered in Scheme Z's loop ramp area. These improvements greatly facilitate the success of the continuous pedestrian connection along this bank of the river from the Esplanade system upstream to Paul Revere Landing Park North and the Boston Harbor waterfront.

Summary: The Preferred Alternative is a major improvement over Scheme Z regarding impacts on open space in the North Point area and on other recreational use of the river surface. Pedestrian access and visual settings are substantially improved.

North Bank Transportation Corridor.
Affected Environment: Downstream from the North Point area is a historic transportation corridor which includes the MBTA commuter railroad tracks and bascule bridge, and the existing I-93 bridge. In the past, several more railroad bridges crossed the river in this area. Today, this area is constrained for future parkland development by the CANA City Square tunnel approaches, and by the Millers River outlet through culverts, where the granite seawalls are interrupted and the riverbank cuts inland. The two designs will compress this transportation-constrained area by moving the highway bridge toward the railroad crossing, leaving an expanded park area downstream.

The MDC master plan proposes an "Arts Park" in the area next to and under the highway bridge, where environmental artworks, sculpture, and other works of art enhance and attract public use of this area, which is constrained by transportation structures in both alternatives. The master plan also proposes a park-related use such as a cafe in or around the historic railroad signal Tower A, which continues to operate the MBTA bascule drawbridge. While these details of future MDC programming as portrayed in the master plan would be MDC actions separate from the Project, they are suggestive of options which could result in viable future public use of this area as part of the overall regional park system.

Impacts: The Preferred Alternative has a 10-lane mainline bridge downstream and a second, four-lane Storrow Drive connector bridge, 70 feet wide, located approximately 100 feet from the railroad bridge. This second bridge limits the open area available for programmed uses near Tower A. The width of this area from the river's edge to the first loop ramp is 120 feet at its narrowest point to 300 feet at its widest, facilitating a more successful design for pedestrians and bicyclists than in Scheme Z. Two segments of the area are covered by bridge shadows, 80 lf of riverbank under the Storrow Drive connector bridge, followed by a 125-foot open area and then 220 lf of shadow under the mainline bridge (this shadow is broken by sunlight passing between the main bridge deck and the cantilevered bridge lanes on the downstream side). Shadows move laterally, affecting different parts of this area, depending on the hour and season. A pair of bridge columns supporting the Storrow Drive connector bridge are located in this area along with a two-legged diamond bridge pier supporting the mainline.

In Scheme Z, this transportation corridor is covered by ramps extending to the shoreline. A total of 400 lf of shoreline is covered, resulting in shadows that move laterally, affecting different parts of this area depending on the hour and season. Scheme Z has three separate bridges carrying 16 lanes; the one closest to the railroad bridge is double-decked. The northbound mainline bridge tower legs are located on shore and in the river; closer to the railroad bridge, four piers supporting the double-deck Storrow Drive connector bridge are located in the north bank area. These ramps and bridges have an adverse effect on the continuous path system along the north bank of the river, and extensive pedestrian improvements are proposed to address Scheme Z's impacts on this area. The Millers River and the proposed path from Rutherford Avenue are also covered by overhead viaduct.

In the Preferred Alternative the loop ramps are farther away from the riverbank than in Scheme Z. Accordingly, the experience of a pedestrian walking downriver is substantially different from that in Scheme Z, whose ramps overhang the riverbank or are tangent to it. This additional width, in a formerly highly constrained area, provides room for a superior design of a barrier-free pedestrian overpass at the railroad tracks, and it permits separation of pedestrian and bicycle paths throughout this area. The riverbank is more open and views to both the Charles and Millers Rivers are less obstructed by columns and bridge piers than in Scheme Z. In addition, the new bridge design is aesthetically superior to Scheme Z's three different bridges. In the Preferred Alternative, which has a second, single-deck bridge in this area, the area between bridges is wider than under Scheme Z and more open, and the entire open space in the transportation corridor is more usable and aesthetically pleasing. As in the North Point area, these improvements reduce the impediment of Scheme Z's constrained riverbank in this area. Accordingly, they greatly facilitate the success of the continuous pedestrian connection along the north bank of the river from the Esplanade system to Paul Revere Landing Park North and the Boston Harbor waterfront, thus achieving a major objective of the MDC's park planning for this area.

Summary: The Preferred Alternative moves the nearest loop ramp away from the riverbank and thus is a major improvement over Scheme Z in making this an acceptable area to pass through as part of the north bank pedestrian/bicycle path system. Consequently, the successful connection of upstream and downstream park nodes through this portion of riverbank is accomplished with the Preferred Alternative. In addition to this major open space objective, relatively large areas are also made available for open space uses in the transportation corridor.

South Bank Transportation Corridor.
Affected Environment: This area extends between Paul Revere Landing Park South (see the Section 4(f) Evaluation) and the railroad crossing, and includes a concrete riverside walkway built by the MBTA, which is continued downstream from the railroad bridge under both designs. The MDC master plan treats this area primarily as part of the riverfront path system, with a path connection to the new Boston Garden. The master plan also proposes boat landings which may pose a conflict with small boat traffic between the locks of the new dam and the railroad drawbridge. The master plan proposes a free-standing pedestrian overpass to the waterfront portion of the Spaulding Hospital site. This overpass is included in the mitigation program (see Chapter 6).

Impacts: In the Preferred Alternative, the long-span mainline bridge extends 15 feet beyond the beginning of the granite seawall, where Paul Revere Landing Park South ends. A single-deck four-lane Storrow Drive connector bridge passes directly over this area. Width of this bridge has been minimized by using 4-foot shoulders. A total of 175 lf of bank is covered by the single-deck bridge structure, whose shadows move laterally, exposing or covering portions of the bank depending on the hour and season. The gap between bridge structures is 195 lf of riverbank. Upstream of the bridge there are 260 lf of open walkway (measured to the moveable span of the railroad bridge where the MBTA walkway now ends). The underside of the Preferred Alternative's two bridges and their supporting piers are major elements in the views from this area. The area has hard-surfaced landscape treatment and provides a vantage point for watching both boats and trains.

In the Preferred Alternative, this portion of riverbank forms a link in a future continuous pedestrian path system, connecting existing Paul Revere Landing Park South with the future Nashua Street Park and the Esplanade via an overpass of the railroad tracks (see the Section 4(f) Evaluation for a discussion of these parklands). With the Preferred Alternative the pedestrian passing through this area has a more open view of aesthetically improved bridges compared to Scheme Z, with fewer bridge piers in the view. In the Preferred Alternative, the single-deck bridge permits a simplified system of twin supporting columns, whereas in Scheme Z, the double-deck bridge in this area requires an outside support system of bents holding the bridge decks. While this portion of the south bank is constrained by adjacent land uses in both alternatives, its successful function as a link between park nodes is achievable in the Preferred Alternative.

In Scheme Z, mainline bridges extend into this area, and a double-deck three-lane Storrow Drive connector bridge passes directly over it. Upstream of the Paul Revere Landing Park South, a total of 280 lf of bank is covered by bridge structure (not counting gaps between bridges), whose shadows move laterally, exposing or covering portions of the bank depending on the hour and season. The gap between bridge shadows is 60 lf. Upstream of the double-deck bridge there are 320 lf of open walkway (measured to the moveable span of the railroad bridge where the MBTA walkway now ends). Views are dominated by the underside of Scheme Z's three bridges and their supporting piers. The area receives hard-surfaced landscape treatment as a Project mitigation measure and provides a vantage point for watching both boats on the river and trains entering and leaving the adjacent North Station.

Summary: The Preferred Alternative benefits the open space in this transportation corridor area, leaving it more open than in Scheme Z. The Preferred Alternative specifically improves this area, providing improved bridge aesthetics and the wider gap between bridges.

Mitigation. Open space impacts are mitigated through the comprehensive mitigation plan for the Charles River Crossing. As directed by the Secretary of the EOEA, MHD has worked with the MDC as well as DEP and the Massachusetts Historical Commission (MHC) to develop this program in a manner that satisfies regulatory interests. In particular, it facilitates implementation of the MDC's park objectives for this portion of the Charles River by developing continuous pedestrian access along the full length of both banks of the river, and major parcels of riverfront land with adequate space for recreation. The mitigation program is described in Chapter 6.

City Square Park. City Square Park in Charlestown is being constructed by MHD on land made available by the CANA project; it is not addressed in the MDC master plan. In Scheme Z, which lacks a northbound downtown on-ramp but has a local off-ramp at City Square, traffic congestion adversely affects the park setting and access. In the Preferred Alternative, northbound traffic can enter the Central Artery at New Sudbury Street, and the local off-ramp is located at Cambridge Street near Sullivan Square. Both traffic improvements reduce traffic in City Square and provide a better setting and safer access to the park. Therefore, the Preferred Alternative has positive impacts on City Square Park.

Wind Impacts On Pedestrianways. The Preferred Alternative and Scheme Z have negligible wind impacts on pedestrianways located at the base of the mainline Charles River bridge tower(s), and no wind impacts at the North Washington Street bridge or the walkway on the Charles River Dam locks. The basis for the conclusion regarding wind impacts is in Appendix G of the 1993 DSEIS/R.

4.2.3 Right-Of-Way And Relocations

This section compares property takings and relocation requirements of the Preferred Alternative and Scheme Z.

4.2.3(a) Right-Of-Way

Property rights required for the Preferred Alternative and Scheme Z include full and partial permanent takings. Requirements for construction (temporary construction easements) will be identified during design development. The Preferred Alternative requires more permanent takings and has greater right-of-way impacts than Scheme Z. The increase in the total number of parcels affected and the total area taken for the Preferred Alternative is due to differences in its alignment, and its land-tunnels, structures, and at-grade elements. Comparisons are shown in Table 4.8.

The affected land parcels in the Charles River Crossing area are identified on Figure 4.18. Table 4.9 shows current parcel ownerships and uses, and indicates the extent of acquisition required for both designs. If there is no taking of a property, the space on the tables is left blank to show comparisons. Detailed right-of-way information for Scheme Z is included in the 1991 FSEIS/R and is not repeated here.

The properties that are affected by the Preferred Alternative and Scheme Z and the extent of acquisition required are based on conceptual designs as developed to date. More precise information will become available as preliminary and final design refinements are made on the Preferred Alternative, and as the appraisal/acquisition process is completed. Additional right-of-way for each of the designs may be required.

Following is a discussion of right-of-way impacts by design.

Preferred Alternative: The Preferred Alternative requires six permanent full takings, three more than Scheme Z. The full takings include Spaulding Rehabilitation Hospital, Boston Thermal Energy Corporation's Minot Station steam generating plant, and other parcels.

The Spaulding Rehabilitation Hospital, located at 125 Nashua Street, is owned and operated by the Spaulding Rehabilitation Hospital Corporation. It is a 10-story, 240,000 (gross) sf building with approximately 284 beds and rehabilitation facilities. The building was constructed in 1970 with a 4-story wing added in 1982. In 1991, 4 more stories were added to the wing.

In addition, the Preferred Alternative requires the acquisition of 31 permanent partial takings. The total area of all permanent takings is 1,279,891 sf, which is 502,310 sf more than Scheme Z.

Scheme Z: Scheme Z requires three permanent full takings. In addition, Scheme Z requires the acquisition of 24 permanent partial takings. The total area of all permanent takings is 777,581 sf. Scheme Z does not affect the Spaulding Rehabilitation Hospital or BTEC's Minot Station steam generating plant (except for its ice facility).

4.2.3(b) Relocation Impacts

The Preferred Alternative displaces additional major commercial properties in comparison to Scheme Z. All relocations are carried out in accordance with Public Law 91-646, as amended, following Project procedures. These relocation procedures are discussed in the 1991 FSEIS/R and are not repeated here. The Preferred Alternative and Scheme Z do not result in any residential displacements. All efforts will be made to minimize acquisition requirements during the final design process.

Preferred Alternative: The Preferred Alternative, as proposed, requires the taking of the Spaulding Hospital and Boston Thermal's Minot Station. An early acquisition of the hospital is necessary to facilitate an early and orderly relocation. The Preferred Atlernative requires the reconfiguration of BSG's operations and access and reduces the size of the Registry building parcel.

Scheme Z: As with the Preferred Alternative, Scheme Z requires the reconfiguration of BSG's operations and access, and reduces the size of the Registry building parcel. Scheme Z does not affect either the Spaulding Rehabilitation Hospital, or the Boston Thermal Energy Corporation's Minot Station steam generating plant.

4.2.4 Economic Impacts

The long-range economic impact forecasts for the design year 2010 presented in the 1991 FSEIS/R remain valid. The nature of economic activity is such that there will be continued fluctuations in the regional business cycle during the coming 2 decades. These macro-economic fluctuations will have far greater impacts on the economy of the study area than will any of the design changes described herein. Therefore, it is anticipated that the overall economic impacts on the study area and the region will be the same under the Preferred Alternative as under the FSEIS/R Proposed Action.

Nevertheless, the Preferred Alternative will have more positive aesthetic impacts on the proposed North Point development in East Cambridge on the north bank of the Charles River and on Charlestown than with Scheme Z. This will occur because the Preferred Alternative will reduce the number of loop ramps in comparison to Scheme Z. The improvement in aesthetics resulting from the reduction in number of loop ramps will have a positive effect on economic activity in these areas. The improvements will make both areas more attractive for development and for locating commercial, residential, or other development activity, and therefore potentially improve the viability of the sites once they are developed.

4.2.5 Joint Development Impacts

Joint development can occur where the Project alignment is over, under, or adjacent to land that has the potential to be developed for purposes unrelated to the Project. The purpose of this section is to identify joint development impacts for each of the alternatives. The section is written as though the joint development potentials have been realized.

Parcel Description. Five parcels of land have potentials for joint development. On the south bank of the Charles River, in or adjacent to the BRA's North Station Economic Development Area (EDA) are: the MGH Nashua Street parcel, the Spaulding Hospital parcel, the MBTA Air Rights Garage parcel, and the Lomasney Way parcel. On the north bank is the Rutherford Avenue parcel. The locations of the parcels are shown on Figure 4.19.

- MGH Nashua Street Parcel: This parcel is located between the MBTA commuter railroad tracks and Nashua Street, north of the new Boston Garden development site and south of the existing Spaulding Hospital site. Under the City of Boston's North Station EDA subdistrict regulations, development of this parcel and the portion of the existing Spaulding Hospital site is permitted to a height of 250 to 300 feet, with a floor area ratio (FAR) of 8 to 10. The land area is defined on the west by Nashua Street, which carries two lanes of traffic in each direction; the MBTA railroad tracks on the east; the parkland on the north; and elevated ramps and high-rise buildings on the south, including the future high-rise buildings of the new Boston Garden development commercial complex. The land is owned by MGH.

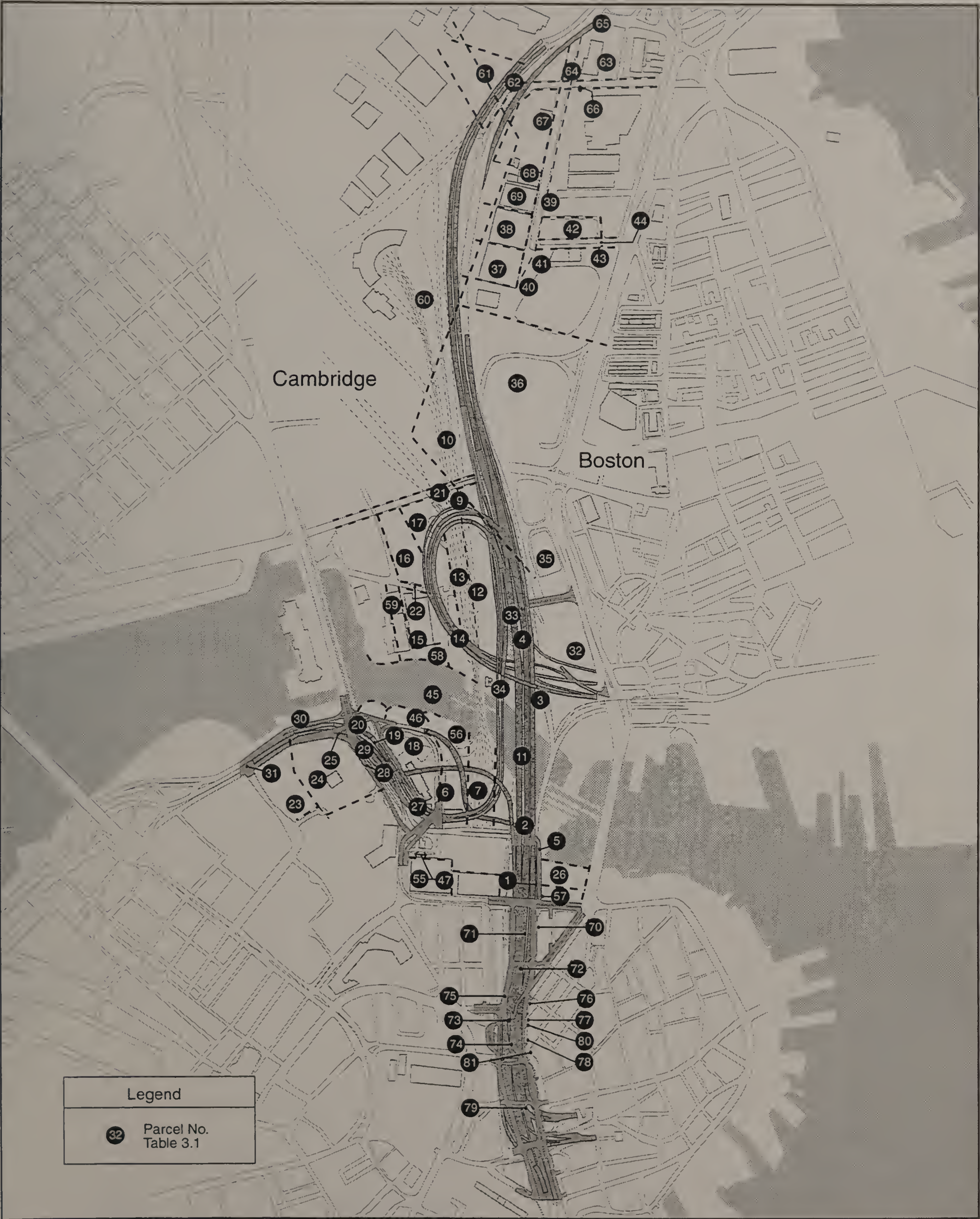
- Spaulding Hospital Parcel: This parcel is located between the MBTA commuter railroad tracks and Nashua Street, north of the MGH/Nashua Street parcel and south of the Charles River. The development potentials of this parcel exist only for the Pre-

Table 4.8

COMPARISON OF TAKINGS

	Preferred Alternative 1993 FSEIS/R (parcels)	Scheme Z 1991 FSEIS/R (parcels)
Number of permanent partial takings	34	24
Number of permanent full takings	6	3
Total	40	27
Total area of permanent takings (approximate)	1,279,891 sf	777,581 sf

Source: Bechtel/Parsons Brinckerhoff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40
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Cambridge
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Boston
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29
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6
27
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55
47
1
26
57
71
70
72
75
76
73
77
80
74
81
78
79
Legend
32 Parcel No. Table 3.1

FIGURE

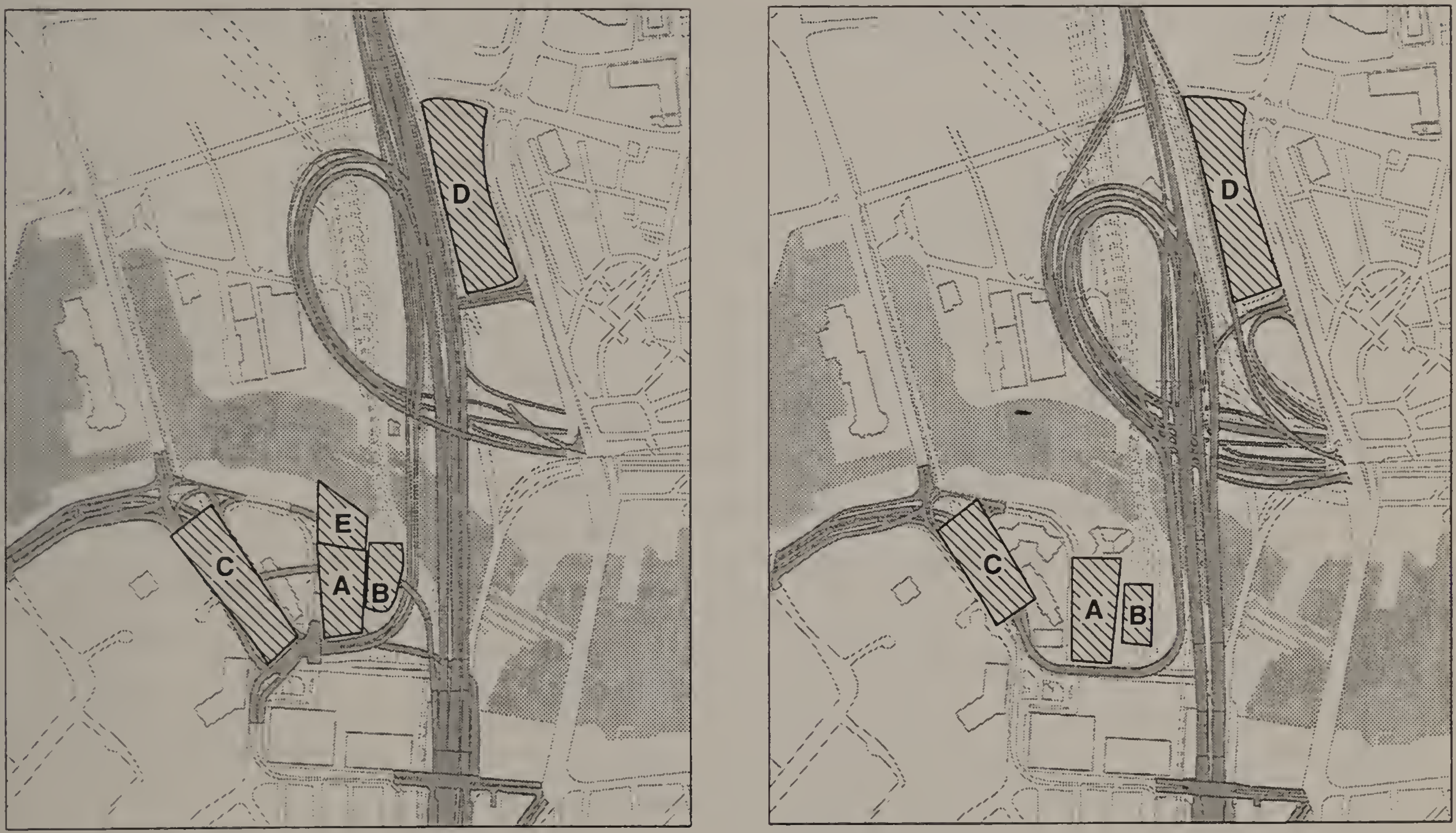
4.18

Right Of Way Parcels

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET



Preferred Alternative

Scheme Z

Legend

A. Nashua Street Parcel
B. Air-Rights Garage Parcel
C. Lomasney Way Parcel
D. Rutherford Avenue Parcel
E. Spaulding Hospital Parcel

FIGURE

4.19 Joint Development Parcels
Future Conditions
Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET

Table 4.9

RIGHT-OF-WAY/LAND OWNERSHIP

			Permanent Takings (approx. sf)			
Parcel No.	Property Owner	Current Use	P/F**	Fee Taking	Underground Highway Easement	Overhead Highway Easement
1	MHD*	office/parking				
2	MDC*	parking	P	7,310		17,890
3	MHD*	roadway/highway				
4	Millers River*	roadway/highway	F	62,080		
5	MHD	Beverly Street parking				
6	The Mass. General Hospital	parking	P	25,460	25,420	16,270
7	MBTA*	tracks platforms	P		26,840	57,090
9	Boston Sand & Gravel	sand/gravel operations	P	102,450		9,350
10	MBTA*	railroad track area	P	40,460		78,290
11	MDC*	Charles/Millers Rivers	P			166,490
12	Boston Sand & Gravel	sand/gravel operations	P			67,740
13	MBTA*	railroad track area	P			36,050
14	MHD*	highway (proposed)				
15	Boston Sand & Gravel	warehouse	P			1,950
16	MDC*	sewer plumbing/chl station	P			20,340
17	Boston Sand & Gravel	light industrial	P			58,430
18	DCPO*	office/institutional	P	33,670	15,030	
19	MDC*	roadway	F	15,251		
20	MDC*	Leverett Circle (MBTA station above)	F	27,900		
21	MBTA*	railroad track area	P			2,510
22	MBTA*	access road	P			1,850
23	Charles River Park "A" Co.	landscaped area	P	9,800		
24	Whittier Pl. Condo Trust	landscaped area	P	8,840		
25	MDC*	pedestrian access	P	2,660		
26	Chardon Realty Trust[1]	parking/wharf				
27	Boston Thermal Energy Corp.	steam plant	F	15,270		
28	MHD*	highway/maintenance				
29	MHD*	highway/maintenance				
30	MDC*	police station/parking	P	18,850		
31	MDC*	pedestrian access	P	3,010		

[1] Extent of acquisition uncertain at this time.

Table 4.9 (Cont.)

RIGHT-OF-WAY/LAND OWNERSHIP

				Permanent Takings (approx. sf)		
Parcel No.	Property Owner	Current Use	P/F**	Fee Taking	Underground Highway Easement	Overhead Highway Easement
32	MHD*	highway				
33	Millers River	roadway/highway	F	4,680		43,270
34	MHD*	highway				
35	BRA	parking	P	9,700		
36	Bunker Hill Community College*	college				
39	Boston and Maine Corporation	street	P			7,650
40	Gerald D. Conway, et al	commercial				
43	BRA	commercial				
45	MDC*	Charles River				
46	DCPO*	parking/heliport				
56	The Spaulding Rehab. Hospital Corp.	rehabilitation hospital	P	19,640	670	
58	Leed Realty Trust	commercial				
59	North Shore Realty Trust	commercial				
60	MBTA*	railroad tracks	P			119,170
61	MBTA*	railroad tracks/storage	P			30,000
62	MBTA*	railroad tracks/storage	P			25,540
63	Edward O. Owens	warehouse/parking	P	370		20,360
64	MBTA*	railroad tracks	P			1,340
65	MBTA*	stairway	F	1,710		
66	MBTA*	railroad tracks	P			1,040
67	ARGI-Mark, Inc.	garage/parking	P			8,590
68	Manual Ginsberg	commercial	P			740
69	Wal-Gil Realty Trust	railroad tracks/commercial	P			1,020
70	Bramen Dow Co.	loading zone	P		9,630	
71	MHD*	parking/highway				
72	MHD*	parking/highway				
73	MHD*	parking/highway				
74	MHD*	parking/highway				
75	MHD*	parking/highway				
76	MHD*	parking/highway				
77	MHD*	parking/highway				
78	MHD*	parking/highway				
79	MHD*	parking/highway				
80	Frank and Santa Roberto	parking	P		150	
81	Peter and Vito Cucchiara	sidewalk	P		70	

* Commonwealth of Massachusetts

** P = Partial; F = Full

Source: Bechtel/Parsons/Brinckerhoff

ferred Alternative. Under the City of Boston's North Station EDA subdistrict regulations, development of this parcel is permitted to a height of 125 to 155 feet, with an FAR of 8 to 10. The land is defined by Nashua Street on the west; the MBTA railroad tracks on the east; the Charles River on the north; and the MGH Nashua Street parcel on the south. The land is owned by MGH.

- Air Rights Garage Parcel: This parcel is located above the MBTA railroad tracks, between Tracks 1 and 10, and north of the new Boston Garden. The air rights garage is also a part of the North Station EDA subdistrict. It is zoned for development as parking or transportation access. It does not include air rights above the proposed Tracks 11 and 12.

- Lomasney Way Parcel: This parcel is adjacent to the North Station EDA subdistrict. It is located in a corridor 210 feet wide between Martha Road and Lomasney Way, between the Registry building and the Charles River Park apartment complex. For the housing community this area is a "front yard"; for the Registry building a "back yard," where loading and service docks presently exist. Martha Road provides access to Charles River Park, and Lomasney Way access to the Registry building. Both streets carry traffic between Causeway Street and Leverett Circle.

- Rutherford Avenue Parcel: The BRA-owned Rutherford Avenue parcel as identified in the 1993 DSEIS/R is not affected by either the Preferred Alternative or Scheme Z.

Methodology. Joint development impacts on the parcels south of the Charles River are discussed by comparing the Preferred Alternative to Scheme Z. For each parcel the first consideration is to determine whether any feasible development potential exists and to identify the nature of that development, including impacts on the site planning and configuration of each parcel, and the buildable area according to current zoning regulations. The second consideration is the impact of Project alternatives on existing or possible pedestrian connections to the joint development parcels. Third, the impact of the Preferred Alternative and Scheme Z on the neighboring context, exposure, and amenity of each joint development parcel is discussed.

In addition, the influence of three major surrounding developments proposed to be built by others before 2000 has been assumed: (1) The relocation of the MBTA elevated Green Line to a subgrade alignment through the Lomasney Way parcel, including the reconstruction of Science Park station, (2) the additional MBTA railroad Tracks 11 and 12, west of the existing Track 10, extending in the future to meet the north facade of the existing Boston Garden, and (3) the completion of the new Boston Garden development, including Buildings A, B, and C at approximately 400 feet high, on Nashua Street and Causeway Street.

4.2.5(a) Preferred Alternative Impacts

In the Preferred Alternative, Ramps N-S and S-N are approximately 32 feet above ground between the high-rise buildings of the new Boston Garden development and the Nashua Street joint development parcel. Ramps CN-L and L-CS are in tunnel beneath the Nashua Street parcel, and a ventilation building is at the southern end of the parcel, built mostly below ground, with two exhaust stacks. The Spaulding Rehabilitation Hospital is taken and the site is redeveloped partly for open space north of the off-ramp boat section and partly for joint development south of the boat section. The air rights garage parcel is reduced in area by approximately 49 percent. The Lomasney Way parcel has joint development potentials at grade facing Nashua Street and Leverett Circle.

Nashua Street Parcel.

Feasibility And Access: The Nashua Street parcel is approximately 1.8 acres. The buildable area is increased if the air rights over Ramp CN-L are developed. The parcel frontage on Nashua Street is approximately 410 feet, and it addresses Nashua Street as the principal street of the North Station EDA with buildings on both sides.

The zoning assumptions for this new parcel result from the overlapping current zoning districts that govern the Nashua Street parcel today. This permits development to a height of 250 to 300 feet, with an FAR of 8 to 10.

At the southern end of the parcel is a ventilation building built below ground, except for certain elements, i.e., air intake shafts, two air stacks, and a stair enclosure. It has two exhaust-air discharge stacks and an air-intake shaft above ground that require construction and planning coordination with the joint development. If the parcel is developed after the ventilation building, it could be necessary to extend the stacks above the physical envelope of the new abutting joint development, at the expense of the developer.

Joint development exists both above and below ground on this parcel. Ramps CN-L and L-CS are in tunnel underneath the parcel. In the event that a subgrade garage development is desired, it is limited by the location of the tunnels, but not prevented or rendered unfeasible. Vehicular access occurs from Nashua Street at the point of service vehicle entry of the ventilation building in the south, and approximately above tunnel L-CS in the north. Service vehicles can access/egress at either south or north locations using a connected service zone on the east side of the parcel facing the MBTA railroad, not visible from Nashua Street. Private vehicles can also access/egress the garage at these locations.

The principal exposures of the parcel are west towards Nashua Street, and north toward the Charles River. The best location for service facilities are east, adjacent to the MBTA railroad, and not visible from Nashua Street.

Pedestrian Circulation: Both sidewalks of Nashua Street accommodate the pedestrian demands of the joint development and those of the planned surrounding developments, but require the addition of new street furniture, lighting, and landscaping. At this part of Nashua Street, development occurs on both sides, with active street frontages introduced by the joint development of the Nashua Street parcel. Pedestrian crosswalks are introduced on Nashua Street to enable the connection between pedestrian networks. The parcel enjoys good visual and physical exposure to pedestrians from all directions. An important network from Causeway Street is helped by the site planning of the ventilation building and the joint development of the Nashua Street parcel at the southern end which opens views in the direction of the pedestrians' destination. The separation of pedestrians from heavy service vehicles requires careful planning to avoid negative impacts to pedestrian circulation. The pedestrian connection from the Nashua Street east sidewalk to the Charles River crosses the intersection of Ramp CN-L and Nashua Street. At Ramp CN-L a crosswalk is located, and the landscape and joint development are designed to facilitate pedestrian passage.

Parcel Environment: The joint development of this parcel extends the character of the North Station EDA along Nashua Street to the Charles River. The joint development is opposite the Suffolk County Jail and 100 Nashua Street. The pattern of buildings in this part of Boston, vis-a-vis buildings both sides of the street, is enabled. The parcel has principal exposures to views of the Charles River, and beyond to Cambridge, Charlestown, and Beacon Hill. Although some restrictions to parcel depth occur due to Ramp CN-L and the ventilation building, the quality of development on this parcel is not compromised by the Preferred Alternative.

Spaulding Hospital Parcel. In the Preferred Alternative, the Spaulding Hospital is taken. Ramp CN-L is aligned through the parcel. It carries traffic from downtown to a new intersection with Nashua Street. The ramp bisects the parcel into north and south portions.

Feasibility And Access: Approximately 1.1 acres of the Spaulding Hospital parcel are north of Ramp CN-L. Approximately 0.6 acre is converted to parkland and approximately 0.5 acre north of Ramp CN-L remains as developable land. This completes the MDC parkland master plan east to the railroad.

Two pedestrian networks of circulation originate in this new parkland: a pedestrian bridge crosses the MBTA railroad tracks for east/west passage, and a pedestrian bridge crosses the bascule bridge for north/south passage.

Approximately 19,285 sf of the Spaulding Hospital parcel south of Ramp CN-L is consolidated with the abutting MGH Nashua Street parcel. Under the City of Boston's North Station EDA subdistrict regulations, the parcel can be developed to a height of between 125 to 155 feet, FAR 8 to 10. The developable area of the former Spaulding site is increased if the air rights over Ramp CN-L are developed. Combined with the Nashua Street parcel it has a gross coverage of 3.2 acres. The same feasibility and access conditions described for the Nashua Street parcel exist for the consolidated Spaulding Hospital site.

Pedestrian Circulation: Two pedestrian networks of circulation originate in the new parkland created at the north portion of the Spaulding Hospital site: a pedestrian bridge crosses the MBTA railroad tracks for east/west passage, and a pedestrian bridge crosses the bascule bridge for north/south passage. Due to Ramp CN-L in a boat section, which bisects the parcel on the south portion of the parcel, it does not enjoy ground-level exposure to pedestrians in the park; at Nashua Street, however, the joint development is fully exposed to pedestrians, and the sidewalk is designed to facilitate pedestrian passage. A crosswalk is located at the intersection of Ramp CN-L and Nashua Street.

Parcel Environment: North of Ramp CN-L the Spaulding Hospital parcel is now parkland. South of Ramp CN-L the Spaulding Hospital parcel that is consolidated with the Nashua Street parcel is appropriately converted to development. The joint development enjoys exposure to Nashua Street and elevated views in all directions.

Air Rights Garage.
Feasibility And Access: The feasibility of developing the air rights garage is diminished because Ramps S-N and N-S occupy much of the zoning envelope of the garage. These ramps reduce the area of the garage parcel by some 49 percent and condense vehicular circulation inside the garage. Moreover, access and egress from Nashua Street are modified. Vehicles must climb to approximately 33 feet above the MBTA railroad tracks by means of either a helical ramp or parallel ramps. As with Scheme Z, two means of egress are preferable, although the need is diminished in the Preferred Alternative, since the total number parking spaces is reduced from Scheme Z.

Pedestrian Circulation: Pedestrian access from North Station and the Charles River requires circulation either through the Nashua Street parcel or what remains of the zone between Ramp CN-L and the MBTA railroad.

Parcel Environment: Since the garage is an air-rights building behind the Nashua Street parcel, it has no impact at street level.

Lomasney Way Parcel.
Feasibility And Access: Joint development potentials exist either in using the air rights between Nashua Street and Leverett Circle, or in the parcel at grade facing Nashua Street. In the portion of the Lomasney Way parcel south of the MBTA Green Line portal in the corridor between the west face of the Registry building and the east face of Charles River Park housing, a 0.33-acre parcel exists which is relatively unencumbered by infrastructure. Due to tunnels, however, its development potential exists entirely above ground. It is possible to gain access from Martha Road, Lomasney Way, or Nashua Street, although the latter would likely become the front of any building on this parcel.

An air-rights corridor approximately 950 feet long and 160 feet wide has development potential between Nashua Street and Leverett Circle. Access to this parcel could avail of the above mentioned parcel facing Nashua Street. Pedestrians could connect in the north from the elevated MBTA Science Park station on the Green Line. Other feasibility and access issues would affect the Registry building, which has a southeastern exposure on this corridor.

Pedestrian Circulation: Pedestrians from Causeway Street approach the joint development from a Nashua Street crosswalk. Pedestrians from the new Boston Garden development approach from between high-rise buildings on Causeway Street. Alternately, pedestrians approach by Martha Road from Leverett Circle, or from Charles River Park housing and MGH. For every route, new landscape design assists the pedestrian environment.

Parcel Environment: Although it is not part of the North Station EDA, this development makes a positive contribution to adjacent buildings. It obscures views of the roads and viaducts in the corridor, and helps to define Nashua Street where several streets and driveways meet.

4.2.5(b) Scheme Z Impacts

Scheme Z locates Ramps CN-S and S-CS (the Storrow connector viaduct) in two tiers, on viaduct between the North Station and the Nashua Street joint development parcels. The Lomasney Way parcel is partially occupied by ramps of the Storrow connector viaduct. This design allows development above and below ground on the Nashua Street parcel between Spaulding Hospital and Building A of the new Boston Garden. The air rights garage parcel could be developed to its full potential. The Lomasney Way parcel has no feasible development opportunities.

Nashua Street Parcel.
Feasibility And Access: Residual land on the Nashua Street parcel subsequent to the construction of Scheme Z has an area of 2.3 acres with a frontage along Nashua Street of 497 feet. The height of the Storrow connector viaduct on the south side is approximately 32 feet. Parcel development may occur above and below ground without physical encumbrance from the highway. The only impacts to joint development are at the parcel edges.

The parcel has two principal exposures. One is west toward Nashua Street, the other north toward the Charles River. Vehicles could access/egress the development and its garage from Nashua Street. The most suitable locations for service areas are at the south, near Ramps CN-S and S-CS, and east, adjacent to the MBTA railroad tracks.

Pedestrian Circulation: Both sidewalks on Nashua Street accommodate the pedestrian demands of the joint development, and those of the planned surrounding developments, but require the addition of new street furniture, lighting, and landscaping as in the Preferred Alternative. The parcel has good physical and visual exposure to pedestrians.

Parcel Environment: The joint development of this parcel extends the character of the North Station EDA along Nashua Street to the Charles River. Nashua Street has development on both sides that creates a continuous mosaic of buildings and active street frontages from the Bulfinch Triangle to the riverside park. The new joint development is adjacent to the Boston Thermal Minot Station, the Registry building, and the Suffolk County Jail, benefiting these existing buildings as well as the future joint development.

Air Rights Garage Parcel.
Feasibility And Access: The Storrow connector viaduct is approximately 30 feet east of the garage. The principal access to the garage is from Nashua Street through the above-mentioned Nashua Street development. The garage has approximately 580 spaces and requires two means of access/egress that combine into one connection with Nashua Street.

Lomasney Way Parcel.
Feasibility And Access: No joint development is feasible on this site because vehicular access to service the development cannot be provided from either Lomasney Way or Martha Road. Moreover, the boat section in this corridor limits joint development below ground.

4.2.5(c) Summary

The size of the Nashua Street parcel differs with either design. The feasibility of its development is unaffected. Scheme Z allows development both above and below ground. The ventilation building required by the Preferred Alternative limits the subgrade development of the Nashua Street parcel. Only the Preferred Alternative affects the adjacent Spaulding Hospital parcel.

The development potential of the MBTA air rights garage parcel is maximized with Scheme Z. The ramps of the Preferred Alternative reduce the garage's capacity, circulation, and access/egress, making its development as a garage for approximately 600 cars essentially infeasible. The Preferred Alternative allows development of the Lomasney Way parcel. The Project preserves joint development potentials on these four parcels to varying degrees, as noted in Table 4.10.

4.2.5(d) Mitigation Of Joint Development Impacts

The highway is designed to minimize adverse impacts to joint development potentials, in addition to meeting the essential safety, economic, constructibility, and aesthetic criteria. The following are the results of efforts to mitigate any adverse joint development impacts and are separate from the compensation for right-of-way takings (see Section 4.2.3, Right-Of-Way and Relocations).

Nashua Street Parcel. The ventilation building is sited and designed to maximize joint development potentials. It is sited toward the southern end of the parcel away from the parkland north of the parcel and the bulk of developable land in the remainder of the parcel. The ventilation building is built mostly below ground except for essential above-ground elements, mainly exhaust stacks and supply vents; and it is designed to facilitate pedestrian passages between the above-ground components.

MBTA Tracks 11 and 12 can be accommodated on the Nashua Street parcel if, following the review of construction staging, it is necessary to do so.

The Nashua Street sidewalks are designed to have the character of downtown streets, to accommodate the pedestrian demands of the Nashua Street parcel joint development, and to have strong pedestrian connections to the surroundings.

Ramp CN-L on the Nashua Street parcel is aligned to maximize the depth of ground-level development on Nashua Street.

Air Rights Garage. The ventilation building is located to least encumber the consolidation of this adjacent air rights garage parcel over the MBTA railroad tracks with the Nashua Street parcel. Tunnels beneath the MBTA railroad tracks are designed to be compatible with the

Table 4.10

COMPARISON OF JOINT DEVELOPMENT IMPACTS

Parcel	Preferred Alternative	Scheme Z
Nashua Street	*Moderate Impact* Partial encumbrances of ventilation building, ramp, and tunnel.	*No Impact* Development potential above and below ground. Two-tier viaduct on south. Spaulding Hospital on north.
Spaulding Hospital	*Moderate Impact* Encumbrance of ramp. Development potentials as parkland, and building consolidated with Nashua Street Parcel.	Not applicable. Spaulding Hospital remains
Air Rights Garage	*Adverse Impact* Two viaducts on south. Parcel size reduction 49 percent; limited vehicle access from Nashua Street.	*No Impact* Two-tier viaduct on south. Access from Nashua Street.
Lomasney Way	*Moderate Impact* Development potentials exist above ground and at ground south of the MBTA Green Line portal.	*Severe Impact* No development potentials
Rutherford Avenue	*No impact* No development encumbrance.	*No Impact* No development encumbrance.

Source: Bechtel/Parsons Brinckerhoff

structure of the air rights garage.

Spaulding Hospital Parcel. The northern portion of this parcel is converted to parkland use. The southern portion consolidates with the Nashua Street parcel. The air rights above the ramp passing through the parcel can be developed, if desirable. The Nashua Street sidewalk is designed to have the character of downtown streets, as described above for the Nashua Street parcel. The intersection of Nashua Street and the ramp passing through the Spaulding Hospital is designed with a pedestrian crosswalk.

Lomasney Way Parcel. The joint development potential in this corridor mitigates the use of a broad corridor of urban land for regional traffic connections. Mitigation is comprised of the following: the design of tunnels and ramps for air-rights development; the facilitating of pedestrian connections to the surroundings; the design of sidewalks for pedestrian passage; and the removal of Ramp M-N that previously existed in this alternative to facilitate joint development potential at ground level on Nashua Street.

Rutherford Avenue Parcel. No mitigation measures are necessary as the parcel is unaffected by the Project.

4.3 AIR QUALITY

4.3.1 Introduction

The 1993 DSEIS/R indicated that the three design alternatives, including the since-selected Preferred Alternative, would have similar effects on local and regional air quality conditions when compared to conditions anticipated under Scheme Z. It further showed that all three design alternatives yield slightly less regional areawide emissions than Scheme Z, and that the amounts of these emissions would not be significantly different between the alternatives. The DSEIS/R concluded that all three alternatives would result in air quality levels that were within the National and State Ambient Air Quality Standards (AAQS), and conformed with the Massachusetts State Implementation Plan (SIP) and the requirements of the 1990 Clean Air Act amendments.

This section presents the results of further analysis of the air quality impacts of the Preferred Alternative. This further analysis takes into consideration the already described refinements to the Preferred Alternative, the change in location of the proposed ventilation building, and the effects associated with the expansion of the traffic network.

Future air quality levels estimated under the Preferred Alternative are compared with future conditions anticipated under Scheme Z, and with applicable National and State AAQS and guidelines. Applying the protocol developed for the DSEIS/R with Massachusetts DEP and EPA, analyses were completed for the years 2001 and 2010. The following information is provided in this section: a description of existing air quality levels; an analysis of the impact of the Preferred Alternative on regional levels of carbon monoxide, volatile organic compounds, nitrogen oxides, and particulate matter (mesoscale analysis); an investigation of the impact of the Preferred Alternative on carbon monoxide levels at critical locations within neighborhoods along the alignment (microscale analysis); and an analysis of impacts associated with the proposed tunnel ventilation system on levels of carbon monoxide, nitrogen dioxide, and particulate matter .

4.3.2 Affected Environment

4.3.2(a) Applicable Air Quality Standards And Guidelines

Seven air pollutants have been identified by EPA as being of concern nationwide: carbon monoxide (CO), hydrocarbons (HC), referred to as volatile organic compounds (VOC), nitrogen oxides (NO_x), ozone (O_3), particulate matter (PM_{10}), sulfur oxides, and lead. National and State AAQS have been established for CO, nitrogen dioxide (NO_2), O_3, PM_{10}, sulfur dioxide, and lead (see Table 4.11). These standards have not changed since publication of the 1991 FSEIS/R. VOC levels are used as an indicator of regional O_3 levels, since they react in the atmosphere with NO_x to form O_3.

In addition, DEP has established a site-specific short-term (1-hour) "policy level" for NO_2 of 320 micrograms per cubic meter ($\mu g/m^3$)(DEP, April 20, 1978). A source is considered to have a "significant impact" under this policy guideline if it is estimated to cause an increase in 1-hour NO_2 levels of 10 percent or more of the policy guideline, i.e., 32 $\mu g/m^3$.

Also, DEP air pollution control regulations (310 CMR 7.38) require that, prior to construction of a major roadway tunnel ventilation system in the Metropolitan Boston Air Pollution Control District, it must be certified that when operated the project will not:

- cause or exacerbate a violation of any National or Massachusetts AAQS
- cause or exacerbate a violation of DEP 1-hour NO_2 policy level
- result in an actual or projected increase in the total amount of nonmethane HC (VOCs) measured within the project area when compared with the no-build alternative

In addition, on October 8, 1992, EPA approved the Commonwealth of Massachusetts regulation for certifying roadway tunnel ventilation systems in the Metropolitan Boston Air Pollution Control District as a revision to the Massachusetts SIP (57 FR 46310-46312). In this final rule, EPA concluded that tunnel ventilation systems are not stationary sources of air pollution subject to Prevention of Significant Deterioration (PSD) or New Source Review permitting requirements identified in the Clean Air Act Amendments (CAAA) of 1990 or in the Commonwealth of Massachusetts Regulation 310 CMR 7.02.

Finally, the 1990 CAAA require that Federally funded transportation projects located within a designated CO or O_3 nonattainment area must result in the elimination or reduction in the number and severity of violations of the AAQS for CO in the area substantially affected by the project. These projects must also assist in the reduction of VOCs and CO emissions in the area, and seek to avoid any increase in these emissions over year 1990 baseline emission levels for these pollutants. The Boston region has been designated as a nonattainment area for both CO and O_3.

4.3.2(b) Pollutants For Analysis

As described in the 1991 FSEIS/R, of relevance to evaluating the impact of the Preferred Alternative are those pollutants that can be traced principally, or in large measure, to motor vehicles. These include CO, VOCs, NO_X, and O_3. In addition, although motor vehicles account for a small portion of total PM_{10} levels, diesel-powered vehicles emit relatively higher amounts of PM_{10} compared to gasoline-powered vehicles. Therefore, PM_{10} is also a pollutant of concern.

Based on these considerations and the nature of the dispersion and reactions of these pollutants in the atmosphere, CO concentrations were estimated using a detailed microscale mobile source impact analysis, a detailed ventilation system impact analysis, and a regional (mesoscale) impact analysis; NO_x and VOCs were analyzed on a mesoscale basis to assess their potential effect on regional O_3 levels; NO_2 emissions from the proposed ventilation building were analyzed on a microscale basis to permit direct comparison with the 1-hour DEP policy level and the annual AAQS for NO_2; and PM_{10} impacts were estimated both on a microscale basis, for emissions from the proposed ventilation building, and on a regional (mesoscale) basis.

Finally, the emission of "noncriteria" toxic air pollutants (toxic pollutants for which criteria have not been established on which to base National AAQS) from motor vehicles is directly related to the level of VOCs emitted from such vehicles. To evaluate the potential changes in air toxic concentrations expected with the Preferred Alternative, regional VOC emissions were compared with the baseline (1990) levels and with projected Scheme Z levels for the years 2001 and 2010.

To demonstrate compliance of the Preferred Alternative with the 1990 CAAA, the following analyses were performed:

- CO levels were estimated at the most critical intersections that are anticipated to be affected by the Preferred Alternative. Since elevated CO levels are generally found at intersections, this analysis evaluated those locations where Project changes had the greatest potential to cause or exacerbate a violation of the National and State AAQS.
- Regional emissions of CO, VOCs, NO_x, and PM_{10}, generated in the study area, were estimated under the Preferred Alternative and Scheme Z, and compared with each other and with emission levels estimated for 1990.
- The potential impacts of the proposed ventilation building associated with the Preferred Alternative on the existing CO, NO_2, and PM_{10} levels were estimated in order to demonstrate compliance with the AAQS and the Massachusetts DEP NO_2 Policy Guideline.

4.3.2(c) Existing Ambient Air Quality Levels

DEP and EPA recommend that assessments of air quality

Table 4.11

NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	**Averaging Period**	**Primary ($\mu g/m^3$)**	**Primary (ppm)**	**Secondary ($\mu g/m^3$)**
Carbon Monoxide (CO)	8-hour[a]	10,000	9.0	10,000
	1-hour[a]	40,000	35.0	40,000
Sulfur Dioxide (SO_2)	Annual	80	0.03	
	24-hour[a]	365	0.14	
	3-hour[a]			1,300
Nitrogen Dioxide[c] (NO_2)	Annual	100	0.05	100
Ozone (O_3)	1-hour[b]	235	0.125	235
PM_{10}	Annual	50	N/A	50
	24-hour[a]	150		
Lead (Pb)	3-month	1.5	N/A	1.5

Notes: a. Not to be exceeded more than once per calendar year.
b. Not to be exceeded more than one day per calendar year.
c. The MDEP has established a 1-hour guideline level of 320 ug/m^3 for NO_2.
N/A= not applicable

Sources: EPA, *National Primary and Secondary Ambient Quality Standards (40 CFR 50).*
Massachusetts DEP, *Massachusetts Ambient Quality Standards (Title 310)*, April 20, 1978.

impacts from proposed highway projects be based on the most recently available 3 years of ambient air quality monitoring data representative of the project area. The most recent 4 years of data available from the DEP ambient air quality monitoring network (1989, 1990, 1991, and 1992) were used to describe existing ambient air quality levels in the Boston area for CO, PM_{10}, NO_2, and O_3. The first 3 years (1989, 1990, and 1991) were used in the 1993 DSEIS/R; 1992 data were not available at the time the DSEIS/R was prepared. The highest monitored levels in the vicinity of the Project area are summarized in Table 4.12. A more extensive description of the monitored data and the location of the monitors is presented in Section 4 of the Air Quality Appendix. These data indicate that there were no violations of the National and State AAQS for CO, NO_2, and PM_{10} recorded at any of the monitoring stations during the 4-year period. In the case of O_3, levels in excess of the standard have been recorded at three of the five monitoring stations during the same 4-year period, but no violations were recorded in 1992.

4.3.2(d) Changes Since The 1991 Projectwide FSEIS/R

The air quality impact assessment presented in the 1991 FSEIS/R was based on DEP monitoring data for the years 1986, 1987, and 1988. These data indicated that concentrations in excess of the AAQS for O_3 were recorded at stations in Chelsea and Sudbury, the closest monitoring stations to the Project area. These data also indicated that the most recent violations of the 8-hour CO AAQS at the North Washington Street monitoring station occurred in 1986, and that maximum 1-hour NO_2 concentrations were greater than the DEP NO_2 policy level in 1986 and 1987 at the Kenmore Square monitoring station, and in 1986 at the Bremen Street monitoring station. No other violations of the AAQS at the monitoring locations were recorded.

Compared to air quality levels reported in the 1991 FSEIS/R for the period 1986 through 1988, air quality levels reported in this FSEIS/R, based on the period 1989 through 1992, have improved since the previous reporting period. There were no violations of the National and State AAQS for all pollutants of concern since the 1991 FSEIS/R, except for O_3. However, the severity of the O_3 levels and the number of violations as recorded by the nearby monitors in recent years have been reduced.

4.3.3 Impacts Of The Preferred Alternative

4.3.3(a) Project Emissions

The relative air quality impacts of the Preferred Alternative are directly related to its effects on vehicular emissions. Localized, areawide, and ventilation building air quality impacts all result from motor vehicle emissions. Changes in traffic volumes, traffic patterns, vehicular speeds, and roadway configurations affect both the amount of pollution generated and how it is dispersed within the affected area.

Emission Factors For CO, VOCs, And NO_x. EPA periodically updates its mobile source emissions estimation model to conform with the most currently available engine test data, to reflect current vehicle control technologies, and to assess the effect of mandated emission control requirements. In this study, motor vehicle emission rates for CO, VOCs, and NO_x were estimated using the MOBILE 5a version of the EPA Mobile Source Emission Factor Model (EPA-AA-TEB-92), the most current available version. Since the MOBILE 5a version did not produce idling emission factors (needed for the CO microscale modeling) at the time the 1993 DSEIS/R was prepared, the MOBILE 4.1 version was used to estimate idling emission factors. The emission factors estimated in this FSEIS/R have been updated from those presented in the DSEIS/R to reflect the most recently updated Massachusetts vehicle registration database; this update resulted in higher emission estimates than those presented in the DSEIS/R.

Vehicular emissions are affected by vehicular speed, ambient temperature, engine temperature (thermal state), vehicle age and mileage distribution, inspection and maintenance programs, fuel volatility, and other localized parameters. While the selection criteria for most of the input parameters were established in the original 1989 Protocol, some parameters have been revised to reflect changes mandated by the 1990 CAAA, to include new options available in the current version of the model, and to be consistent with the 1990 emission inventory prepared by DEP. Detailed discussions of the assumptions and parameters that were used in this analysis are provided in Section 5 of the Air Quality Appendix.

Since the future emission factors forecast by MOBILE 5a (and MOBILE 4.1) for this analysis are different from the ones forecast in the 1993 DSEIS/R because of the updated vehicle registration database, the air quality levels for Scheme Z were reanalyzed using the new procedures in order to permit a direct comparison of emission rates between those estimated under the Preferred Alternative and Scheme Z.

Emission Factors For PM_{10}. Motor vehicle-related sources of PM_{10} include emissions from vehicle tailpipes, brakes, tire wear, and re-entrained road dust. PM_{10} emissions from tailpipes, brakes, and tire wear were estimated using the EPA-PART program *Emissions from Mobile Sources* (EPA 460/3-85-007). Fugitive dust emissions for re-entrained road dust were estimated using the most recent version of the EPA *Compilation of Air Pollutant Factors AP-42.* These emission factors are the same as the ones used in the 1991 FSEIS/R.

4.3.3(b) Estimated Areawide (Mesoscale) Pollutant Emissions

The total quantities of motor vehicle-related pollutants emitted in the study area (i.e., the tons of pollutants emitted each day) were estimated to provide an indication of the change in air quality in the region, including relative changes in the levels of CO, VOCs, NO_x, PM_{10}, and O_3.

The emissions generated under the Preferred Alternative are compared to those generated under Scheme Z for the years 2001 and 2010, and to those generated in the 1990 base year. This information is used to determine the conformity of the Preferred Alternative with the 1990 CAAA and the SIP.

Study Areas. The study area has been expanded since publication of the DSEIS/R in July 1993. This enlarged and updated travel forecasting network includes larger portions of Somerville and Cambridge, and areas west of Boston and southwest of downtown (including the Kenmore Square area). A detailed explanation of the expanded study area can be found in Section 4.1 in Part I and in the Air Quality Appendix in Part II of this FSEIS/R. All major highways, roadways, and local streets within the study area are included in this assessment. Figure 4.20 outlines the major geographic zones, including the expanded area, that were analyzed within the overall roadway network.

Traffic Data. VMT, VHT, average travel speed, and vehicle classification for the different roadways were estimated for each of the major geographic zones as part of the overall Project traffic analysis. The traffic data used to estimate these emissions for 1990, 2001, and 2010 are provided in Section 6 of the Air Quality Appendix.

Estimated 1990 Baseline Year Areawide Emissions. Estimated peak daily areawide emissions of CO, VOCs, NO_x, and PM_{10} are provided in Table 4.13 (annual areawide emissions are provided in Section 6 of the Air Quality Appendix). The results indicate that approximately 176 tons per day of CO, 19 tons per day of VOCs, 15 tons per day of NO_x, and 11 tons per day of PM_{10} were emitted by motor vehicles using the roadway network in the study area in 1990. Of these totals, approximately 67 percent of CO, 63 percent of VOCs, 56 percent of NO_x, and 84 percent of PM_{10} were emitted from motor vehicles using local streets within the study area. These total emission burdens are greater than those presented in the DSEIS/R since they cover a larger expanded study area. Table 4.13 also presents the subtotal emission rates for the original study area, as well as the subtotal emission rates for the expansion of the study area.

Estimated Future Areawide Emissions For 2001. Estimated peak daily areawide emissions of CO, VOCs, NO_x, and PM_{10} for both the Preferred Alternative and Scheme Z for the year 2001 are shown in Table 4.14. When compared to the 1990 levels, the estimated VMT are expected to increase 27 percent, VHT are expected to increase 25 percent, and average network speed is expected to increase 1 percent with Scheme Z. These results are larger than those presented in the DSEIS/R due to the expansion of the study area and the use of updated vehicle registration data.

The results indicate that with Scheme Z, approximately 138 tons per day of CO, 14 tons per day of VOCs, 13 tons per day of NO_x, and 12 tons per day of PM_{10} would be emitted by motor vehicles using the roadway network in the study area. Of these totals, approximately 62 percent of CO, 66 percent of VOCs, 49 percent of NO_x, and 82 percent of PM_{10} will be emitted by vehicles travelling on local streets within the study area.

Pollutant emission levels calculated for the expanded study area under Scheme Z in 2001 are estimated to result in a reduction of 22 percent in CO, 29 percent in VOCs, and 16 percent in NO_x compared to 1990 levels. In the case of PM_{10}, a 10 percent increase is anticipated. The reductions in CO, VOC, and NO_x emissions are due to the expected cleaner vehicles in the future as mandated by Federal and State regulations. In the case of PM_{10}, most of the emissions are due to roadway dust that is resuspended

Table 4.12

HIGHEST AMBIENT AIR QUALITY MONITORED LEVELS IN THE VICINITY OF THE PROJECT AREA

(1989 TO 1992)

Pollutant	Site	Time Period	Concentration	AAQS
Carbon Monoxide	340 Bremen Street (East Boston)	1-hour 8-hour	13.4ppm 8.9ppm	35ppm [1] 9.0ppm [1]
PM_{10}	One City Square (Charlestown)	24-hour annual mean	96 $\mu g/m^3$ 38 $\mu g/m^3$	150 $\mu g/m^3$ [1] 50 $\mu g/m^3$
Nitrogen Dioxide	340 Bremen Street	1-hour annual mean	470 $\mu g/m^3$ 60 $\mu g/m^3$	320 $\mu g/m^3$ [2] 100 $\mu g/m^3$
Ozone	Chelsea	1-hour	0.137ppm	0.125ppm [3]

Notes: [1] Not to be exceeded more than once per year.

[2] DEP 1-hour NO_2 policy guideline is 320 $\mu g/m^3$, not to be exceeded more than once per year.

[3] Not to be exceeded more than one day per calendar year.

Sources: Air Quality Data Reports for 1989, 1990, and 1992, Commonwealth of Massachusetts Department of Environmental Protection, Division of Air Quality Control; 1991 Annual Report of Air Quality in New England, Environmental Protection Agency, Region I, May 1992.

Table 4.13

PEAK DAILY EMISSION BURDENS
IN THE STUDY AREA FOR THE YEAR 1990
(tons per day)

Affected Zone	CO	VOC	NO_X	PM_{10}
Area North of Causeway Street				
highways and ramps	9.58	1.20	1.16	0.21
covered highways	0.00	0.00	0.00	0.00
local streets	6.61	0.70	0.52	0.61
Central Area				
highways and ramps	13.56	1.68	1.46	0.26
covered highways	2.87	0.35	0.32	0.04
local streets	21.29	2.14	1.09	1.35
I-93/I-90 Interchange				
highways and ramps	9.24	1.15	1.09	0.20
covered highways	0.00	0.00	0.00	0.00
local streets	11.62	1.21	0.89	0.81
South Boston				
highways and ramps	0.00	0.00	0.00	0.00
covered highways	0.00	0.00	0.00	0.00
local streets	10.23	1.10	0.96	0.93
East Boston				
highways and ramps	2.25	0.28	0.29	0.05
covered highways	1.04	0.13	0.15	0.02
local streets	8.94	0.93	0.58	0.68
East Cambridge				
highways and ramps	0.00	0.00	0.00	0.00
local streets	14.86	1.58	1.12	1.32
Subtotal Original Study Area	112.09	12.46	9.61	6.47
West Cambridge/Somerville				
highways and ramps	10.33	1.32	1.44	0.26
local streets	27.27	2.90	2.09	2.46
Kenmore				
highways and ramps	9.86	1.04	0.69	0.80
local streets	16.63	1.75	1.17	1.35
Subtotal Expanded Study Area	64.08	7.01	5.39	4.87
Total Highways, Tunnels, and Ramps	58.71	7.16	6.59	1.84
Total Local Streets	117.46	12.31	8.42	9.50
Totals	176.17	19.47	15.01	11.34

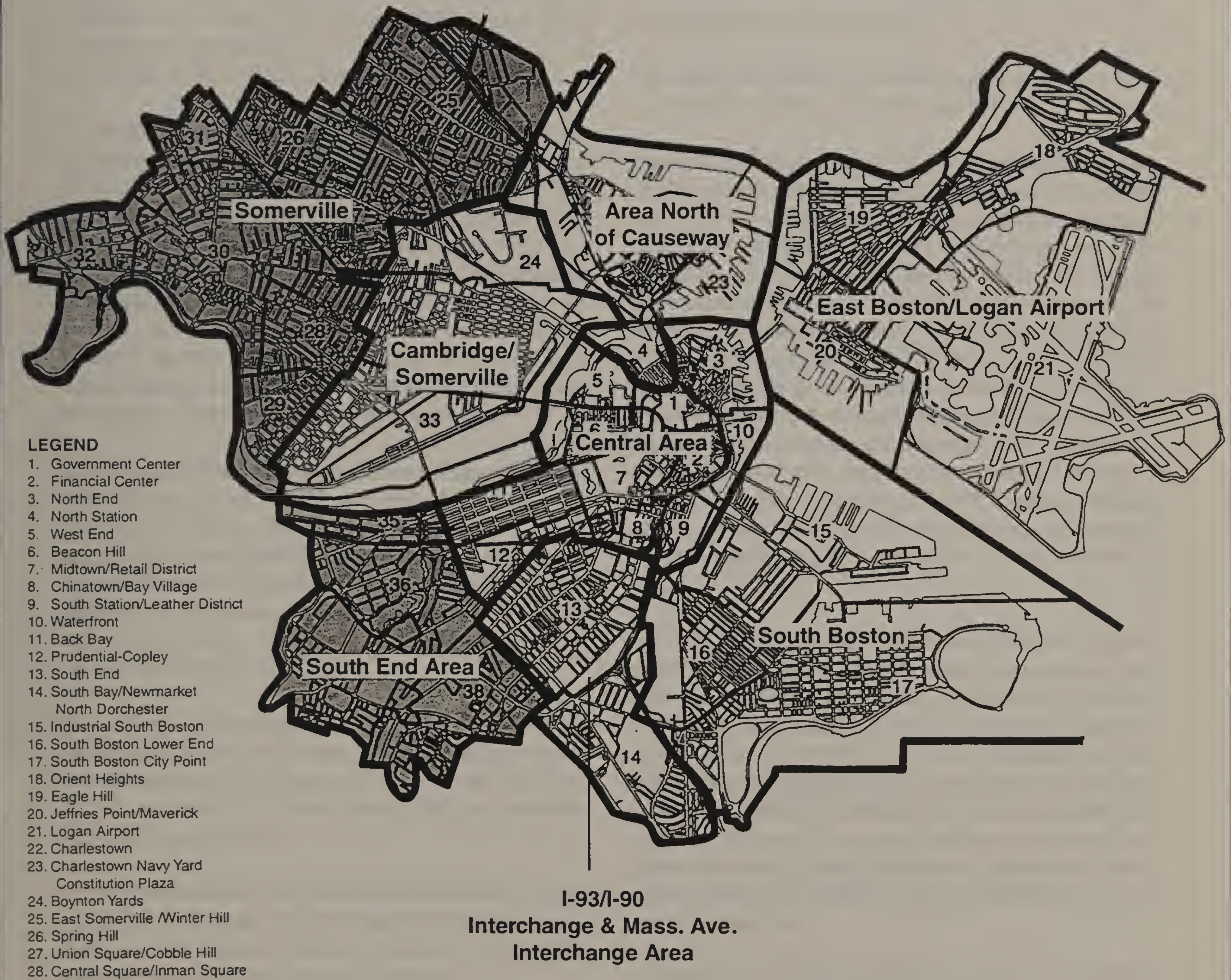
Source: Bechtel/Parsons Brinckerhoff

Table 4.14

PEAK DAILY EMISSION BURDENS IN THE STUDY AREA FOR THE YEAR 2001
(tons per day)

Affected Zone	CO		VOC		NO_X		PM_{10}	
Area North of Causeway Street	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
highways and ramps	7.23	7.09	0.67	0.65	1.08	1.03	0.26	0.24
covered highways	0.93	1.39	0.09	0.12	0.16	0.18	0.03	0.03
local streets	4.52	4.05	0.46	0.41	0.35	0.32	0.61	0.56
Central Area								
highways and ramps	7.32	7.51	0.63	0.63	0.89	0.89	0.21	0.21
covered highways	4.42	4.49	0.39	0.41	0.60	0.63	0.10	0.11
local streets	14.92	14.62	1.60	1.57	0.86	0.85	1.51	1.49
I-93/I-90 Interchange								
highways and ramps	7.08	6.95	0.61	0.60	0.88	0.88	0.21	0.21
covered highways	0.21	0.22	0.02	0.02	0.04	0.04	0.01	0.01
local streets	8.39	8.27	0.92	0.09	0.67	0.66	0.94	0.94
South Boston								
highways and ramps	0.58	0.58	0.05	0.05	0.06	0.06	0.01	0.01
covered highways	2.39	2.28	0.24	0.23	0.42	0.41	0.07	0.07
local streets	7.13	7.16	0.75	0.76	0.63	0.63	0.94	0.94
East Boston								
highways and ramps	3.21	3.28	0.29	0.29	0.44	0.44	0.10	0.10
covered highways	0.77	0.86	0.08	0.08	0.14	0.14	0.02	0.02
local streets	4.99	4.96	0.53	0.53	0.33	0.33	0.56	0.55
East Cambridge								
highways and ramps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
local streets	11.62	11.55	1.22	1.21	0.85	0.85	1.44	1.43
Subtotal: Original Study Area	85.72	85.26	8.54	8.46	8.41	8.35	7.03	6.94
West Cambridge/Somerville								
highways and ramps	11.06	10.75	0.91	0.89	1.22	1.20	0.29	0.29
local streets	22.51	22.58	2.36	2.37	1.65	1.65	2.80	2.79
Kenmore								
highways and ramps	7.39	7.35	0.78	0.78	0.54	0.53	0.90	0.89
local streets	11.49	11.57	1.21	1.22	0.83	0.84	1.40	1.41
Subtotal: Expanded Study Area	52.44	52.26	5.26	5.26	4.24	4.22	5.39	5.38
Total: Highways, Tunnels and Ramps	52.60	52.75	4.74	4.75	6.46	6.44	2.22	2.20
Total: Local Streets	85.56	84.76	9.06	8.98	6.19	6.13	10.20	10.12
Totals:	138.17	137.51	13.81	13.72	12.65	12.57	12.42	12.32

Source: Bechtel/Parsons Brinckerhoff


31
26
25
22
Somerville
27
32
30
28
29
Area North of Causeway
24
23
18
19
East Boston/Logan Airport
20
21
Cambridge/Somerville
4
3
5
1
33
34
6
Central Area
10
2
7
35
8
9
15
12
36
13
South Boston
16
South End Area
17
38
37
11
14
I-93/I-90 Interchange & Mass. Ave. Interchange Area

LEGEND

1. Government Center
2. Financial Center
3. North End
4. North Station
5. West End
6. Beacon Hill
7. Midtown/Retail District
8. Chinatown/Bay Village
9. South Station/Leather District
10. Waterfront
11. Back Bay
12. Prudential-Copley
13. South End
14. South Bay/Newmarket North Dorchester
15. Industrial South Boston
16. South Boston Lower End
17. South Boston City Point
18. Orient Heights
19. Eagle Hill
20. Jeffries Point/Maverick
21. Logan Airport
22. Charlestown
23. Charlestown Navy Yard Constitution Plaza
24. Boynton Yards
25. East Somerville /Winter Hill
26. Spring Hill
27. Union Square/Cobble Hill
28. Central Square/Inman Square
29. West Cambridgeport
30. Harvard Square
31. Porter Square
32. West Cambridge
33. M.I.T.
34. East Cambridge/Lechmere
35. Boston University/Kenmore
36. Fenway
37. Longwood
38. Lower Roxbury

☐ Expanded Study Area

NOTE: The former network area DSEIS/R filed 1993 comprised districts 1-24, 33 & 34

FIGURE 4.20

Affected Zone For Mesoscale Air Quality Analysis

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

by vehicle movement. As a consequence, the effect of cleaner vehicles has minimal impact toward PM_{10} emission reductions.

Areawide emissions for the Preferred Alternative when compared to Scheme Z for the year 2001 result in a reduction of 0.5 percent for CO, 0.7 percent for VOCs, 0.6 percent for NO_x, and 0.8 percent for PM_{10}.

Estimated Future Areawide Emissions For Year 2010. Estimated peak daily areawide emissions of CO, VOCs, NO_x, and PM_{10} for both the Preferred Alternative and Scheme Z for the expanded study area for the year 2010 are shown in Table 4.15. When compared to 1990 levels, the estimated 2010 VMT with Scheme Z are expected to increase 38 percent, VHT are expected to increase 47 percent, and average network speed is expected to decrease 7 percent. The results are larger than those presented in the DSEIS/R due to expansion of the study area and the use of updated vehicle registration data.

The results indicate that under Scheme Z approximately 154 tons per day of CO, 13 tons per day of VOCs, 12 tons per day of NO_x, and 14 tons per day of PM_{10} would be emitted by motor vehicles using the roadway network in the study area. Of these totals approximately 61 percent of CO, 65 percent of VOCs, 49 percent of NO_x, and 82 percent of PM_{10} will be emitted by vehicles travelling on local streets in the study area.

When emission rates under Scheme Z for the year 2010 are compared with 1990 emission levels, the results indicate a reduction of 13 percent in CO, 34 percent in VOCs, and 18 percent in NO_x. In the case of PM_{10}, a 19 percent increase is anticipated.

Areawide emissions under the Preferred Alternative when compared to Scheme Z for the year 2010 result in a reduction of 0.7 percent for CO, 0.3 percent for VOCs, 0.6 percent for NO_x, and 0.7 percent for PM_{10}.

4.3.3(c) Localized Mobile Source Carbon Monoxide Impacts

A mobile source microscale analysis was completed to estimate ambient levels of CO near 23 major congested intersections which are anticipated to be affected by the Preferred Alternative. The analysis was designed to determine whether the Preferred Alternative would cause or exacerbate an exceedance of the CO AAQS. The analysis also compared estimated CO levels at these intersections under the Preferred Alternative with those estimated for Scheme Z. Due to the previously described changes between the methodology used in the 1993 DSEIS/R and this FSEIS/R, Scheme Z was reanalyzed in order to permit a direct comparison between the Preferred Alternative and Scheme Z.

One-hour and 8-hour CO levels were estimated at each intersection for the years 2001 and 2010.

Modeling Methodology. The CO modeling analysis for the 23 critical intersections in the study area followed the same general methodology used in estimating intersection CO levels in both the 1991 FSEIS/R and the 1993 DSEIS/R. The most recent version of the EPA mobile source emission factor model (MOBILE 5a) was used to estimate vehicular emissions rather than MOBILE 4 which was used in the 1991 FSEIS/R. The CAL3QHC (Version 2.0) air quality dispersion model (EPA-454/12-92-006) was used to estimate ambient pollutant concentrations at each receptor location analyzed. Locations at which estimates were completed are identified on Figure 4.21, and include the locations where, based on existing and estimated future traffic conditions, the greatest Project-related air quality impacts would be expected to occur.

The selection of the intersections analyzed and the principal inputs to the CAL3QHC model were made in consultation with EPA Region I and DEP, following the EPA *Guidelines for Modeling Carbon Monoxide at Roadway Intersections* (EPA-454/R-92-005). A detailed description of the methodology and assumptions used in this analysis is provided in Section 6 of the Air Quality Appendix. In order to estimate pollutant concentrations where maximum Project impacts are expected to occur, 10 to 18 receptor locations were modeled near each selected intersection.

Traffic Data. Traffic data for the analysis were derived from the traffic counts, speed data, and other information developed as part of the traffic analysis for this FSEIS/R. This traffic data for this revised analysis includes the effects of the expanded traffic network for all scenarios analyzed. The 8-hour CO analysis was based on estimated traffic levels during the peak 8-hour traffic period (10:00 AM to 6:00 PM). Peak 1-hour concentrations of CO were obtained by dividing peak 8-hour CO levels by 0.6 to account for the observed fact that vehicle volumes, vehicle speeds, and meteorological conditions during the

8-hour period will vary from those that will persist for only 1 hour.

Meteorological Conditions. The transport and dispersion of pollutants emitted from motor vehicles are influenced by wind direction, wind speed, and the temperature profile of the atmosphere. Values for these parameters were chosen to result in reasonable worst-case pollutant concentrations at each prediction site.

Background CO Levels. Estimation of total ambient air quality requires the inclusion of pollutant background levels. Background level is the component of the total concentration not accounted for directly through the microscale modeling analysis. Applicable background concentrations were added to the modeling results to obtain the total pollutant concentration at each receptor site for each analysis year. The background levels used in this analysis were developed following the same methodology as in the 1991 FSEIS/R, and are described in Section 6 of the Air Quality Appendix.

Estimated Future CO Levels Based On Microscale Modeling. The results of the CO microscale analysis are summarized in Tables 4.16 and 4.17. Provided are estimates of the highest 1-hour and 8-hour concentrations of CO near each of the 23 intersections analyzed under both the Preferred Alternative and Scheme Z for the years 2001 and 2010. The results of the analysis indicate that:

- One-hour and 8-hour CO concentrations in 2001 for both designs analyzed will be less than (in compliance with) the National and State AAQS of 35 ppm and 9 ppm at all locations analyzed. The maximum 1-hour and 8-hour CO concentrations (14.2 ppm and 8.5 ppm) were estimated near the intersection of Causeway and Merrimac Streets and Lomasney Way under Scheme Z, and the maximum 1-hour and 8-hour CO concentrations (13.8 ppm and 8.3 ppm) were estimated near Leverett Circle under the Preferred Alternative.

- One-hour and 8-hour CO concentrations in 2010 for both designs analyzed will be less than (in compliance with) the National and State AAQS of 35 ppm and 9 ppm at all locations analyzed. The maximum 1-hour and 8-hour CO concentrations (14.7 ppm and 8.9 ppm) were estimated near the intersection of Cambridge and Staniford Streets under Scheme Z, and the maximum 1-hour and 8-hour concentrations (14.6 ppm and 8.7 ppm) were also estimated near the intersection of Cambridge and Staniford Streets under the Preferred Alternative.

CO levels estimated under the Preferred Alternative are very similar and, in general, slightly lower than those estimated under Scheme Z. The principal reason for these lower CO levels is better traffic operations on arterial streets associated with the Preferred Alternative.

Of the 23 intersections considered, 11 have lower estimated CO levels in 2001 under the Preferred Alternative as compared with those estimated under Scheme Z, and seven have higher estimated levels. In 2010, 13 have lower estimated levels under the Preferred Alternative and seven have higher levels. The decreases in estimated CO levels that are expected to occur at City Square, North Washington and Commercial Streets (Keany Square), and Rutherford Avenue/BSG are due primarily to the proposed New Sudbury Street on-ramp near Government Center, which would divert traffic away from these intersections and onto I-93 northbound. The increases in estimated CO levels at Leverett Circle and Charles Circle are due to the difference in the design of the Storrow Drive tunnel, which would have two lanes under Scheme Z and only one lane under the Preferred Alternative.

4.3.3(d) Ventilation Building Emissions Impacts

Introduction. The Preferred Alternative requires one ventilation building on the south bank of the Charles River (designated ventilation building 8). As indicated in the 1991 FSEIS/R, Scheme Z does not require any ventilation buildings since it does not include tunnels north of Causeway Street. Therefore, the air quality impacts resulting from the Preferred Alternative's ventilation building emissions were analyzed on the basis of incremental impacts relative to the Scheme Z design due to additional tunnel section included in the Preferred Alternative. Analytical modeling was used to evaluate the CO, NO_2, and PM_{10} impacts resulting from these emissions in the DSEIS/R. Results of the analysis indicate that the operation of the proposed ventilation building result in air quality levels that are within all applicable National and State AAQS and DEP Policy Guidelines for NO_2.

Due to the refinements of the Preferred Alternative, the underground ventilation building 8 was relocated approximately 300 feet southeast of its original location as presented in the DSEIS/R. Consequently, the ventilation

Table 4.15

PEAK DAILY EMISSION BURDENS IN THE STUDY AREA FOR THE YEAR 2010
(tons per day)

Affected Zone	CO		VOC		NO_X		PM_{10}	
Area North of Causeway Street	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative	Scheme Z	Preferred Alternative
highways and ramps	8.72	8.38	0.67	0.64	1.08	1.01	0.29	0.27
covered highways	1.30	1.85	0.10	0.13	0.16	0.18	0.03	0.03
local streets	5.41	4.89	0.47	0.42	0.38	0.35	0.73	0.68
Central Area								
highways and ramps	9.30	8.83	0.64	0.62	0.87	0.86	0.23	0.23
covered highways	4.51	5.00	0.35	0.38	0.58	0.61	0.11	0.12
local streets	17.14	16.99	1.52	1.50	0.88	0.88	1.71	1.69
I-93/I-90 Interchange								
highways and ramps	7.53	7.50	0.55	0.55	0.84	0.84	0.22	0.22
covered highways	0.21	0.23	0.02	0.02	0.04	0.04	0.01	0.01
local streets	9.22	9.11	0.83	0.83	0.64	0.64	1.04	1.03
South Boston								
highways and ramps	0.70	0.69	0.05	0.05	0.06	0.06	0.02	0.02
covered highways	2.75	2.65	0.23	0.22	0.42	0.41	0.08	0.08
local streets	8.10	8.07	0.71	0.72	0.64	0.64	1.08	1.08
East Boston								
highways and ramps	3.73	3.85	0.28	0.28	0.42	0.43	0.11	0.11
covered highways	0.87	0.99	0.07	0.08	0.13	0.14	0.03	0.03
local streets	5.49	5.43	0.49	0.48	0.33	0.33	0.62	0.61
East Cambridge								
highways and ramps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
local streets	12.54	12.85	1.10	1.13	0.82	0.83	1.55	1.56
Subtotal Original Study Area	97.54	97.31	8.07	8.07	8.29	8.24	7.84	7.77
West Cambridge/Somerville								
highways and ramps	12.72	11.85	0.87	0.83	1.17	1.15	0.31	0.31
local streets	23.45	23.51	2.06	2.06	1.55	1.55	2.95	2.95
Kenmore								
highways and ramps	7.90	7.82	0.70	0.69	0.51	0.51	0.97	0.95
local streets	12.07	12.15	1.06	1.07	0.78	0.79	1.47	1.48
Subtotal Expanded Study Area	56.14	55.23	4.69	4.65	4.02	4.00	5.70	5.68
Total Highways, Tunnels and Ramps	60.25	59.64	4.53	4.49	6.28	6.25	2.40	2.37
Total Local Streets	93.43	93.01	8.24	8.23	6.03	6.00	11.15	11.08
Totals	153.68	152.64	12.76	12.72	12.31	12.24	13.54	13.45

Source Bechtel/Parsons Brinckerhoff

Table 4.16

ESTIMATED 1- AND 8-HOUR WORST-CASE CARBON MONOXIDE LEVELS
YEAR 2001 - MOBILE SOURCES
(ppm)

	1- Hour		8-Hour	
No. Location	**Scheme Z**	**Preferred Alternative**	**Scheme Z**	**Preferred Alternative**
1. Gilmore Bridge & O'Brien Highway	12	11.8	7.2	7.1
2. City Square	10.2	7	6.1	4.2
3. Leverett Circle	10.7	13.8	6.4	8.3
4. Causeway/Merrimac/Lomasney	14.2	13.2	8.5	7.9
5. Causeway & Haverhill Road	9.2	9.2	5.5	5.5
6. Causeway & Beverly Road	10.2	9.7	6.1	5.8
7. North Washington & Commercial (Keany Sq.)	11.8	9.5	7.1	5.7
8. New Sudbury & Congress Streets	12.3	12.8	7.4	7.7
9. New Chardon/Haverhill/North Washington	12.2	12.2	7.3	7.3
10. New Chardon/Stillman/North Washington	11	11.2	6.6	6.7
14. Congress & State Streets	7.5	7.5	4.5	4.5
15 . State Street & Surface Road	11.2	10.8	6.7	6.5
34. Cambridge & Staniford Streets	13.5	13.5	8.1	8.1
40. Rutherford/C-L @ Bunker Hill College	6.5	6.2	3.9	3.7
41. Rutherford & Gilmore Bridge	8.3	8	5	4.8
42. Rutherford/BSG	11.7	8.3	7	5
43. Lechmere Square	8.8	8.7	5.3	5.2
44. Nashua Street and Martha Road	12	10.7	7.2	6.4
45. Cambridge & New Chardon Streets	13.3	13.7	8	8.2
46. Cambridge & New Sudbury Streets	9.5	9.8	5.7	5.9
47. Charles Circle	11	11.7	6.6	7
48. Broadway & Third Street	7.7	7.8	4.6	4.7
49. Sullivan Square	11.3	11.3	6.8	6.8

Notes:
1. Analysis sites numbered 1-34 coincide with numbering utilized in the 1991 FSEIS/R; locations 40-49 are new sites.
2. CO 1-hour AAQS is 35 ppm.
3. CO 8-hour AAQS is 9 ppm.
4. Values include 1-hour CO background level of 4.0 ppm.
5. Values include 8-hour CO background level of 2.4 ppm.

Source: Bechtel/Parsons Brinckerhoff

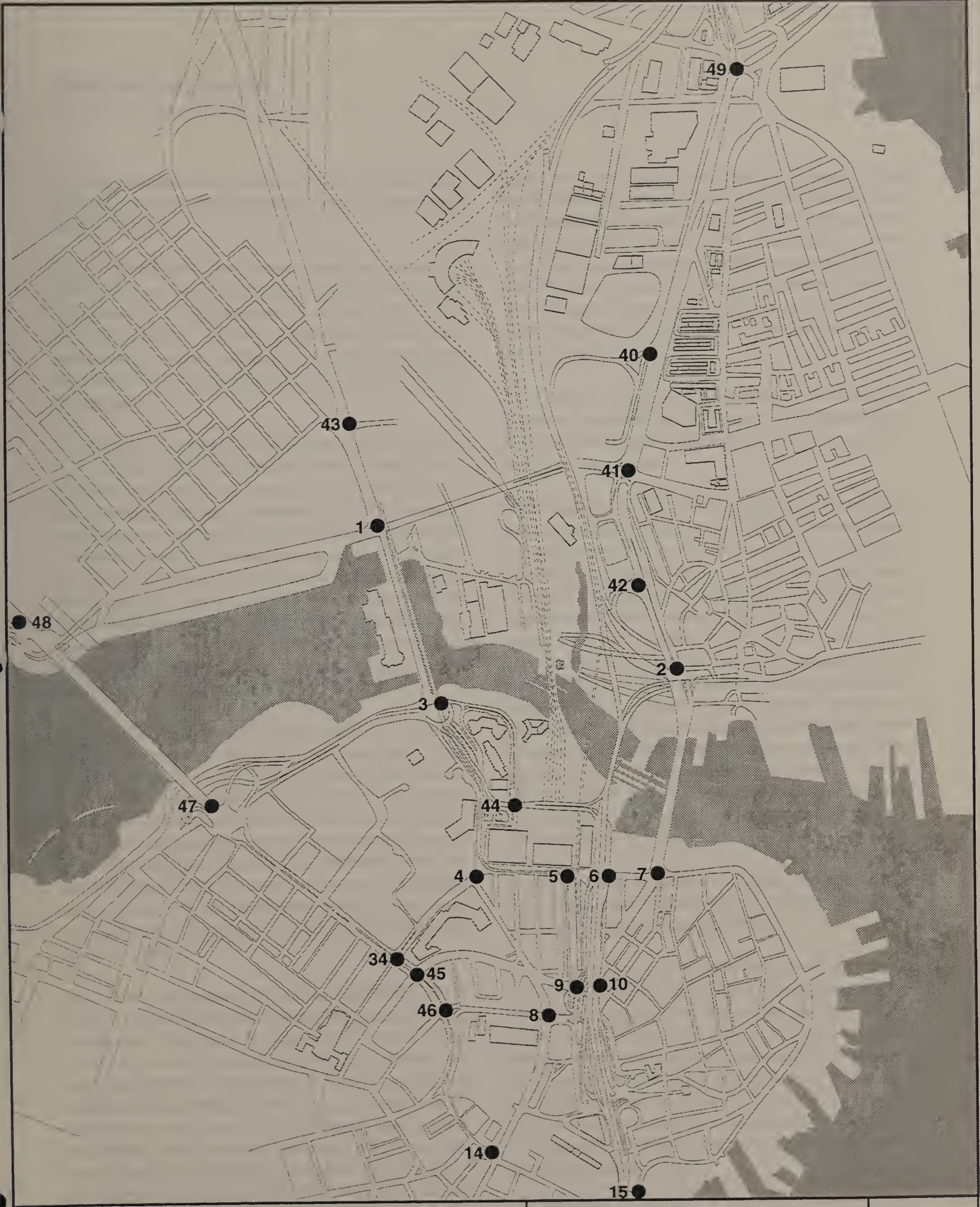
Table 4.17

ESTIMATED 1- AND 8-HOUR WORST-CASE CARBON MONOXIDE LEVELS
YEAR 2010 - MOBILE SOURCES
(ppm)

	1- Hour		8-Hour	
No. Location	**Scheme Z**	**Preferred Alternative**	**Scheme Z**	**Preferred Alternative**
1. Gilmore Bridge & O'Brien Highway	12.6	13.4	7.6	8
2. City Square	13.9	8.7	8.4	5.2
3. Leverett Circle	12.2	13.7	7.4	8.2
4. Causeway/Merrimac/Lomasney	14.2	14.4	8.6	8.6
5. Causeway & Haverhill Road	10.9	10.9	6.6	6.5
6. Causeway & Beverly Road	10.9	11.1	6.6	6.6
7. North Washington & Commercial (Keany Sq.)	14.2	11.1	8.6	6.6
8. New Sudbury & Congress Streets	12.6	13.9	7.6	8.3
9. New Chardon/Haverhill/North Washington	13.1	13.7	7.9	8.2
10. New Chardon/Stillman/North Washington	11.1	12.4	6.7	7.4
14. Congress & State Streets	8.4	8.6	5.1	5.1
15. State Street & Surface Road	11.4	11.2	6.9	6.7
34. Cambridge & Staniford Streets	14.7	14.6	8.9	8.7
40. Rutherford/C-L @ Bunker Hill College	7.6	7.1	4.6	4.2
41. Rutherford & Gilmore Bridge	8.9	8.4	5.4	5
42. Rutherford/BSG	12.4	9.6	7.5	5.7
43. Lechmere Square	9.1	9.6	5.5	5.7
44. Nashua Street and Martha Road	13.2	11.4	8	6.8
45. Cambridge & New Chardon Streets	14.4	13.7	8.7	8.2
46. Cambridge & New Sudbury Streets	11.4	10.7	6.9	6.4
47. Charles Circle	11.4	12.7	6.9	7.6
48. Broadway & Third Street	8.2	8.1	5	4.8
49. Sullivan Square	12.7	12.2	7.7	7.3

Notes:
1. Analysis sites numbered 1-34 coincide with numbering utilized in the 1991 FSEIS/R; locations 40-49 are new sites.
2. CO 1-hour AAQS is 35 ppm.
3. CO 8-hour AAQS is 9 ppm.
4. Values include 1-hour CO background level of 4.4 ppm.
5. Values include 8-hour CO background level of 2.6 ppm for the Preferred Alternative and 2.7 ppm for Scheme Z.

Source: Bechtel/Parsons Brinckerhoff


49
40
43
41
1
42
48
2
3
47
44
4
5
6
7
34
45
9
10
46
8
14
15

FIGURE

4.21

Locations of Mobile Sources
Carbon Monoxide Modeling Sites

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 400 800 1600 FEET

building emissions impact analysis was repeated to confirm the minimum ventilation stack height as determined in the DSEIS/R.

In this FSEIS/R analysis, the most current versions of the EPA-approved air quality models and their associated EPA-developed or approved software were used. A detailed description of the technical approach, assumptions, model input, and the methodology used for compliance demonstration are presented in Section 7 of the Air Quality Appendix.

The location of ventilation building 8 is shown in Figure 4.22. In the absence of advanced level of design information concerning future structures situated on top of or surrounding the proposed ventilation building, reasonable assumptions about building dimensions and systems (air intakes and operable windows) were used in this air quality impact assessment. Additional air quality studies, including physical modeling, will be undertaken in the future to facilitate the final design of the ventilation building and to provide that the operation of the ventilation buildings will comply with the applicable air quality standards and guidelines.

Control Technology. A detailed examination of potential means to control ventilation building emissions was prepared for the 1991 FSEIS/R and presented in a Bechtel/Parsons Brinckerhoff report, *Control Technology Review for Tunnel Ventilation Systems*. The result of that examination indicated that there are no technologies available for the effective removal of the pollutants at the low concentrations found in tunnel-ventilated air. This issue was revisited in 1993 to determine whether there were any changes in technology that may affect this result, and none were found.

The Good Engineering Practice Ventilation Stack Height. Large existing and planned structures surround the proposed ventilation building site. Due to air flow disruption caused by these structures, low pressure regions, referred to as cavity and wake regions, are formed immediately downwind of the buildings. These low pressure regions may cause the exhaust plume from ventilation building 8 to be drawn downward to produce high ground level concentrations. Therefore, in general, it is good engineering practice (GEP) to design an exhaust stack to a height that avoids aerodynamic downwash of the exhaust plume caused by adjacent or nearby buildings. This height, referred to as the GEP stack or vent height, was calculated for the Preferred Alternative based on the revised location of the ventilation building, using the Building Profile Input Program (BPIP) code as developed by the EPA (August 1993). The code was developed in accordance with the guidance contained in *Guideline for Determination of Good Engineering Practice Stack Height, Technical Support Document for the Stack Height Regulations*, EPA (1985) (see Section 7.2.1 of the Air Quality Appendix).

The GEP stack height for the Preferred Alternative was calculated to be 940 feet (287 meters). Construction of a structure of this height in downtown Boston was considered to be impractical.

Ventilation Stack Height Determination. In the DSEIS/R, an evaluation was performed to identify a more practical stack height. This analysis indicated that a stack height of 330 feet would not result in a violation of any applicable AAQS or DEP policy guidelines. This height was based on a full-build condition of a potential future development in the ventilation building 8 area and a maximum zoning height for this future development of 300 feet. Further air quality studies, including physical modeling, will be undertaken to determine the shortest possible stack height for ventilation building 8 based on surrounding existing structures and advanced level of design information concerning future structures. Experience with other Project ventilation buildings indicates that substantial reductions can be attained through further analysis in final design.

An analysis was completed to confirm the adequacy of this exhaust stack height for the Preferred Alternative, using the procedures described below.

Cavity Analysis: A cavity analysis was performed using the SCREEN2 model (EPA, 1992) to estimate pollutant concentrations at receptors close to the ventilation building for the 330-foot stack height. A cavity nominally extends three building heights downwind of a structure. This analysis was selected as the first step of the stack height confirmation procedure because ground-level impacts within the cavity region are often much greater, and therefore more limiting in terms of facility design, than ground impacts beyond it.

Ventilation emission rates for the ventilation building under the Preferred Alternative are given in Table 4.18. Building parameters and the refined stack height used in the calculations are given in Table 4.19. The methodology employed for the cavity analysis is discussed in detail in Section 7.2.3 of the Air Quality Appendix.

Dispersion Analysis: Once the 330-foot stack height was confirmed using the cavity analysis, pollutant impacts under the conditions when the exhaust plume was not entrained into the cavity were estimated. Consistent with the 1991 FSEIS/R, the EPA-approved Industrial Source Complex Short-Term (ISCST2) Dispersion Model was used to calculate pollutant concentrations. The ISCST2 model has been revised by EPA since the 1991 FSEIS/R, and the most recent version (April 1993) was used in this study. In addition, the BPIP code was also used to calculate direction-specific building dimensions for use in the ISCST2 model.

The most recent 5 years of readily available hourly surface meteorological data (1985 to 1989), collected at the Boston Logan Airport National Weather Service (NWS) station, was used in the modeling analysis. Due to its proximity to the study area, data collected at this station is considered to be the most representative data for performing the required dispersion analysis. Concurrent daily mixing height values were obtained from upper-air data collected at the Portland, Maine, NWS station (B/PB, 1993). The Portland NWS station is located approximately 100 miles north along the extended Atlantic coast from Boston. No notable terrain features exist that would cause significant climatic differences between these two locations. In this study, the upper-air data collected at Portland is considered to offer the most regionally representative and readily available database. A detailed discussion of the representativeness of the Portland data is provided in Section 7.2.4 of the Air Quality Appendix.

Most of the NO_x emitted by motor vehicles is in the form of nitric oxide (NO). Once emitted, NO is converted to NO_2 via reactions in the atmosphere with other oxidants, mainly O_3. The Ozone Limiting Method (OLM) was used to account for the conversion of NO into NO_2. A maximum overall conversion rate of 81 percent was estimated based on techniques developed and approved by EPA and DEP for use in the 1991 FSEIS/R.

Pollutant concentrations resulting from ventilation building emissions of the Preferred Alternative were calculated using a comprehensive receptor network. This network consisted of a uniform polar receptor grid extending 2 kilometers downwind of ventilation building 8 (720 receptors) and a set of discrete receptors placed at sensitive locations such as air intakes or operable windows of nearby buildings, residences, and hospitals.

The methodology used to perform this dispersion analysis is discussed in detail in Section 7.2.4 of the Air Quality Appendix.

Model Results: The maximum predicted NO_2, CO, and PM_{10} impacts for ventilation building 8 are presented in Table 4.20. The applicable AAQS and DEP Policy Level are also provided in the table for comparison.

The modeling results indicate that maximum 1-hour concentrations occurred at the nearby planned Boston Garden tower due to plume impingement. The maximum 1-hour NO_2 concentration level, which includes measured concentrations from background sources, is 81 percent of the DEP Policy Level. The results also show that the maximum model predicted CO and PM_{10} impacts are less than 22 percent and 4 percent of their corresponding AAQS, respectively. When these values are added to the appropriate measured background concentrations, the total maximum concentrations are all below (within) the applicable AAQS (see Section 4.3.3(e)).

These results are based on the assumption that the future development situated on top of and adjacent to ventilation building 8 is at its full-build condition, with solid structures 300 feet in height. However, it is envisioned that ventilation building 8 will be in operation prior to the existence of the future development for an undetermined period of time. Consequently, a confirmation check of the 330-foot ventilation stack height was also performed for the scenario with no future development. A preliminary modeling investigation indicated that air quality impacts without this future development are less than those predicted with the future full-build condition, due to the absence of the downwash effect produced by the development structures. Therefore, no further analysis of the no-development scenario will be made. In the event that a lower stack height is desired, further air quality studies, including physical modeling, will be undertaken to determine the lowest possible stack height for ventilation building 8. Recertification of ventilation building 8 to a lower stack height would be necessary.

In summary, results of the dispersion analysis confirmed that emissions from a stack height of 330 feet result in

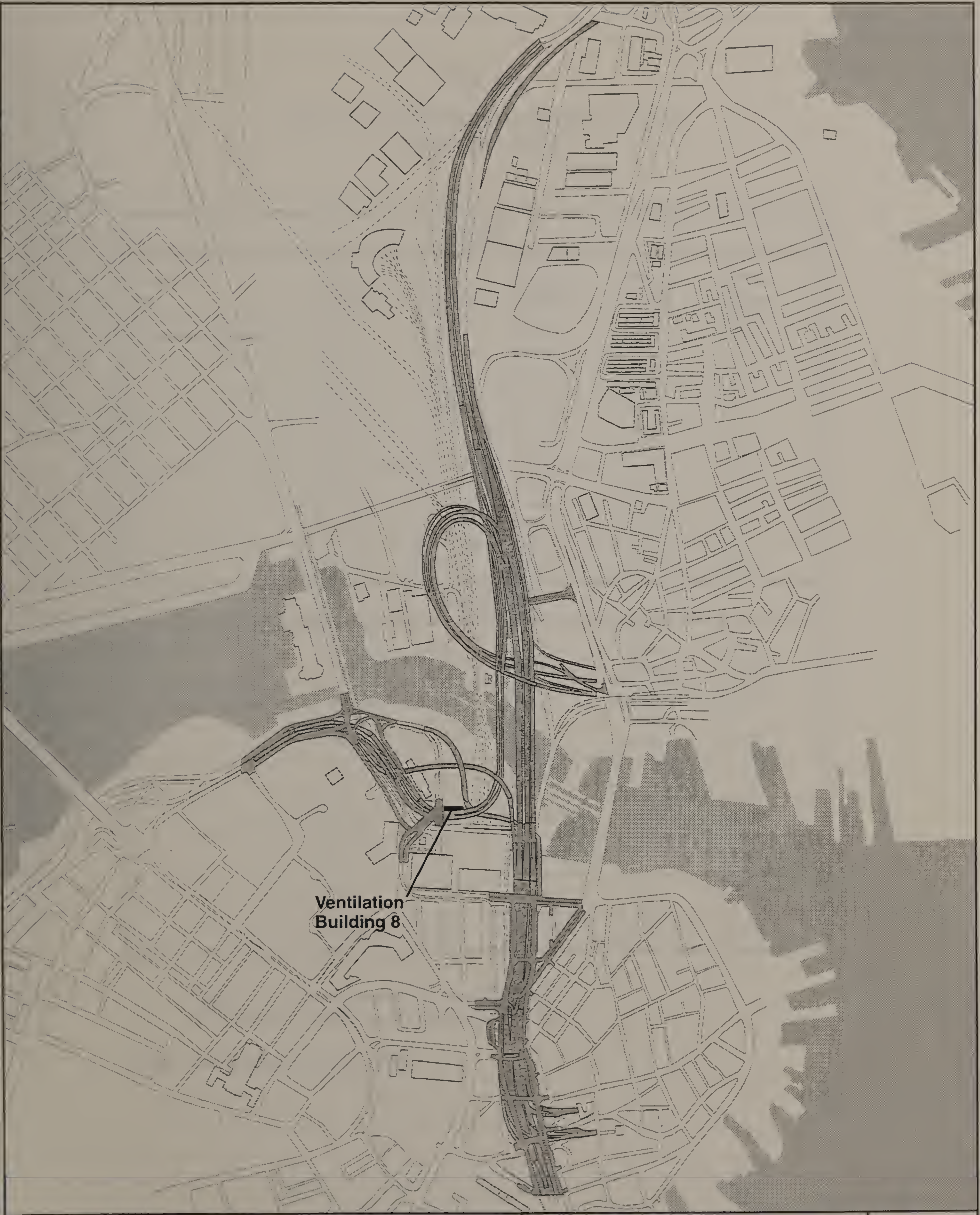

Ventilation Building 8

FIGURE 4.22

Proposed Location For Ventilation Building: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0
600
1400 FEET

Table 4.18

VENTILATION BUILDING EMISSION RATES
(grams per second)

Year 2001					
Building No.	**CO 1-hour**[1]	**CO 8-hour**[2]	**NO_x 1-hour**	**NO_x 8-hour**	**PM_{10} 8-hour**
8 Preferred Alternative	8.103	5.154	0.641	0.521	0.087
1	5.738	4.263	0.753	0.533	N/A
3	18.514	13.763	2.348	1.86	N/A
4	25.757	14.742	2.624	1.915	N/A
5	7.303	3.989	0.921	0.6	N/A
6	6.049	2.945	0.761	0.444	N/A
7	10.758	5.592	1.385	0.775	N/A

Year 2010					
Building No.	**CO 1-hour**[1]	**CO 8-hour**[2]	**NO_x 1-hour**	**NO_x 8-hour**	**PM_{10} 8-hour**
8 Preferred Alternative	10.015	4.941	0.719	0.465	0.087
1	6.809	5.517	0.788	0.658	0.226
3	27.01	16.984	2.63	2	0.694
4	37.887	18.479	3.041	2.095	0.728
5	9.803	6.03	0.999	0.77	0.294
6	8.47	5.276	0.86	0.647	0.25
7	14.258	9.564	1.481	1.156	0.416

[1] Peak 1-hour emissions based on peak 1-hour traffic.

[2] Peak 8-hour emissions based on peak 8-hour traffic.

Source: Bechtel/Parsons Brinckerhoff

Table 4.19

VENTILATION BUILDING DESIGN PARAMETERS

Building No.	Alternative	Stack Height (m)	Exit Velocity (m/s)	Stack Effective Diameter (m)
8	Preferred Alternative	100.6	7.62 (peak hour)	5.33
1		41.1	8.13	10.07
3		73.7	8.13	13.08
4		38.1	8.13	13.7
5		38.9	8.13	12.38
6		27.7	8.13	8.64
7		32.7	8.13	13.20

Note: Vent effluent temperature assumed as ambient.

Source: Bechtel/Parsons Brinckerhoff

Table 4.20

MAXIMUM PREDICTED NO_2, CO AND PM_{10} IMPACTS FROM VENTILATION BUILDING 8

Project Year	Alternative	NO_2 (µg/m³)		CO (ppm)		PM_{10} (µg/m³)	
		1-hour[1,3]	Annual[2]	1-hour[1]	8-hour[2]	24-hour[2]	Annual[2]
2001	Preferred Alternative	260	1.97	5.84	0.72	N/A	N/A
2010	Preferred Alternative	261	1.76	7.22	0.69	5.48	0.33
	AAQS	N/A	100	35	9	150	50
	DEP Policy Level	320	N/A	N/A	N/A	N/A	N/A

Notes: [1] 1-hour values are based on the emission rate for the peak traffic hour.

[2] 8-hour, 24-hour and annual values are conservatively based on the emission rate for the peak 8-hour average traffic period.

[3] The maximum 1-hour NO_2 values from the OLM include background concentrations.

N/A= not applicable

Source: Bechtel/Parsons Brinckerhoff

ambient air quality levels in compliance with all the applicable ambient AAQS and guidelines, under a full-build scenario.

4.3.3(e) Combined Air Quality Impacts

The final step in assessing the adequacy of the refined ventilation stack height was the performance of an analysis of the combined impacts of ventilation building emissions and emissions from other nearby sources. If the total impacts at surrounding receptor locations are less than all AAQS, the confirmation of the stack height is considered complete.

As discussed in Section 4.3.2(a), EPA concluded that tunnel ventilation systems are not "stationary sources" within the context of the Clean Air Act. Therefore, Project ventilation buildings are not subject to the PSD or NSR permitting requirements of a stationary source. Consequently, the analytical interactive source analysis, which is an integral part of a PSD permit application, is not required for ventilation building 8 when performing its compliance demonstration with the applicable AAQS. Instead, air quality levels contributed by other nearby sources are estimated using monitored data collected in the study area.

As discussed in Section 4.3.3(a), Project emissions are those pollutants exhausted from motor vehicles travelling within the area affected by the Project. Air quality impacts from surface traffic have been analyzed in Section 4.3.3(c), Mobile Source Impacts. Vehicle emissions from traffic in the tunnel are released to the atmosphere through the ventilation building stacks. Results of the air quality impacts from tunnel traffic are presented in Section 4.3.3(d), Ventilation Building Emissions Impacts. This section addresses the combined impacts from both the surface and tunnel traffic emissions.

Combined Impacts From All Ventilation Buildings. The results reported in Section 4.3.3(d) conclude that air quality (CO, NO_2, PM_{10}) emissions from the operation of ventilation building 8 alone do not create air quality levels that exceed AAQS. In addition to the ventilation building serving the tunnel sections in the Area North of Causeway Street, the entire Central Artery/Tunnel Project includes six other planned ventilation buildings (ventilation buildings 1, 3, 4, 5, 6, and 7). All are located at least 2,000 feet from ventilation building 8. Under certain meteorological conditions, it is possible for exhaust plumes from various ventilation buildings to merge, causing a combined air quality impact greater than that from ventilation building 8 alone. Therefore, the combined impact from all ventilation building emissions was also modeled. Total concentrations used in the demonstration include contributions from all the ventilation buildings as well as the background sources in the area. If these total concentrations are less than the corresponding applicable standards and DEP's 1-hour policy guideline value for NO_2, then a demonstration of compliance is considered to have been made.

Ventilation building emission rates and building design parameters used for the model calculations are given in Tables 4.18 and 4.19. The same air quality model (ISCST2) as described in Section 4.3.3(d) was used to perform this evaluation. Contributions from the background sources which were not yet been accounted for in the modeling were determined using monitoring data collected in the study area. Background CO concentrations were developed using the procedures described in Section 4.3.3(c). Background PM_{10}, NO_2, and O_3 concentrations used in this study were provided by DEP. A detailed description of the conversion of NO_x to NO_2 can be found in Section 7.2.3 of the Air Quality Appendix.

The modeling results indicate that the location of maximum impact locations for all the ventilation buildings combined are the elevated receptors located either on tall buildings near ventilation building 4 or on the planned Boston Garden office building near ventilation building 8.

Maximum predicted concentrations of NO_2, CO, and PM_{10} for all ventilation buildings are presented in Table 4.21. As shown in the table, the maximum combined CO, NO_2, and PM_{10} impacts from all ventilation buildings, when added to their appropriate background concentrations, are below the National and State AAQS and guidelines.

Combined Mobile Sources And Ventilation Building Impacts. Mobile source impacts occur primarily adjacent to congested roadways under low wind speeds and relatively stable atmospheric conditions. Peak ground-level impacts from vehicular exhausts passing through the ventilation buildings generally occur several hundred feet from the buildings under moderate to high wind conditions and unstable atmospheric conditions. It is unlikely that the location of maximum air quality impacts from these different source types would be identical.

In order to estimate the potential combined impacts of these sources, peak ground-level 1-hour and 8-hour CO impacts from all proposed ventilation buildings in the entire Project were analyzed near the same 23 intersections evaluated in the mobile source analysis. The same meteorological conditions assumed to present the worst case dispersion scenario for the mobile source analysis were also used. A description of this analysis is provided in Section 8 of the Air Quality Appendix.

The highest ground-level CO impacts from all of the proposed ventilation buildings at each of the 23 intersections were 0.13 ppm for the 1-hour and 0.06 ppm for the 8-hour peak. These levels are one to two orders of magnitude less than the estimated CO levels directly from the roadway traffic. When these values are added to the peak 1-hour and 8-hour CO values predicted for the mobile source analysis, all total predicted values are less than (in compliance with) the National and Massachusetts AAQS. Therefore, the combined impacts of the mobile source emissions on the roadway and ventilation building releases from tunnel traffic at any receptor location under worst-case meteorological conditions would be less than (in compliance with) applicable AAQS. In addition, the results indicate that the highest combined estimated CO levels under the Preferred Alternative would be less than those estimated under Scheme Z.

4.3.3(f) In-Tunnel Air Quality Levels

The tunnel ventilation system has been designed with an installed supply air capacity of 65 cubic feet-per-minute (cfm) per lane-foot of tunnel. The air volume was selected to dilute in-tunnel CO concentrations to 120 ppm during bumper-to-bumper congested traffic conditions. However, actual in-tunnel CO concentration are expected to range between 20 and 50 ppm during normal peak hour (i.e., non-emergency) traffic conditions.

Generally, motorist exposure to the in-tunnel environment during peak hour traffic is expected to be less than 10 minutes. One of the longest continuous in-tunnel trips possible on the Project consists of a vehicle entering a tunnel portal in South Boston and travelling westbound on I-90 under the Fort Point Channel, proceeding through the South Bay interchange to I-93 northbound, transitioning to Ramp CN-S , and emerging from the tunnel in the Leverett Circle area. Such a trip is estimated to cover 16,130 feet within tunnel over a period of approximately 8.5 minutes during peak PM traffic in the year 2010. This 8.5-minute in-tunnel exposure is well below the FHWA and EPA guidelines. These guidelines, at a CO concentration of 50 ppm or less, state that "...an adequate margin of safety would exist if the time-averaged concentration of CO does not exceed 120 ppm and the exposure time does not exceed 15 minutes for peak rush hour traffic."

4.3.4 Summary Of Impacts

The results of this analysis indicate that, in general, the Preferred Alternative would result in similar effects on local and regional air quality conditions to those anticipated with Scheme Z. The regional areawide emissions are slightly less than the emissions estimated for Scheme Z. The microscale analysis indicates that the intersections analyzed comply with the CO AAQS, and that the Preferred Alternative has beneficial effects when compared to Scheme Z. The operation of the proposed ventilation building, as currently designed, results in air quality levels well within all applicable National and State AAQS and DEP Policy Guidelines for NO_2.

4.3.5 Conformance With SIP And 1990 CAAA

The Boston metropolitan area is designated as not being in attainment with the NAAQS for CO and O_3, and in attainment with the other pollutants for which national standards have been promulgated. As such, the 1990 CAAA require that certain actions or strategies be undertaken. These actions or strategies must be designed to reduce CO and O_3 concentrations in the area by legislated deadlines (December 31, 1995, for CO, and November 15, 1999, for O_3).

Massachusetts has prepared and submitted to EPA a revision to the SIP describing strategies, including transportation control measures, that are proposed to achieve the attainment of these standards as required. Also submitted to EPA was a Transportation Improvement Plan (TIP), which is a multiyear, intermodal program of transportation projects proposed to assist in meeting the goals of the SIP.

Important recent conformity-related documents prepared by the State and submitted to EPA include the following:

- Air Quality Determination for the Boston MPO Region, for both the TIP and the Boston Transportation Plan (September 26, 1991).

Table 4.21

MAXIMUM PREDICTED NO$_2$, CO, AND PM$_{10}$ CONCENTRATION LEVELS FROM ALL VENTILATION BUILDINGS FOR COMPLIANCE DEMONSTRATION

Project Year		NO$_2$ (µg/m^3)		CO (ppm)		PM$_{10}$ (µg/m^3)	
		1-hour[1,3]	Annual[2,3]	1-hour[1,4]	8-hour[3,4]	24-hour[3,4]	Annual[2,3]
2001	Background	variable	60	4	2.4	N/A	N/A
	Total	260	62.2	7.36	3.03	-	-
2010	Background	variable	60	4.4	2.6	96	38
	Total	261	62.3	8.55	3.2	103.8	38.8
	AAQS	N/A	100	35	9	150	50
	DEP Policy Level	320	N/A	N/A	N/A	N/A	N/A

Notes: [1] The 1-hour NO$_2$ and CO values are based on the emission rate for the peak traffic hour. For 1-hour NO$_2$ impacts, the conversion of NO$_x$ to NO$_2$ was based on the OLM.

[2] The 8-hour CO, 24-hour PM$_{10}$, and annual NO$_2$ and PM$_{10}$ are based on the emission rate for the peak 8-hour traffic period. For NO$_2$ impacts, 100 percent conversion of NO$_x$ to NO$_2$ was assumed.

[3] The 1-hour NO$_2$ and annual concentrations include the highest modeled values. The use of the highest (instead of the second highest) 1-hour NO$_2$ value for compliance demonstrations is conservative.

[4] The 1-hour and 8-hour CO and 24-hour PM$_{10}$ values include the modeled highest second-highest values.

Source: Bechtel/Parsons Brinckerhoff

- SIP submissions specific to the Central Artery/Tunnel Project (September 10, 1993). These include reports on Transit System Improvements, High-Occupancy Vehicle Lanes, and Certification of Tunnel Ventilation Systems.

- Conformity Determination for the FY 1993-1995 TIP (September 30, 1993).

- SIP Submission (November 15, 1993).

The EPA has developed *Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans on Transportation Plans, Programs, and Projects Funded or Approved Under Title 23 USC or the Federal Transit Act-Interim Guidelines,* which were issued jointly by the EPA and the U.S Department of Transportation (DOT) on June 7, 1991; and EPA's *Final Conformity Rule* was recently issued (published in the *Federal Register* November 24, 1993).

FHWA, FTA, and the local Metropolitan Planning Organization (MPO) have determined that the transportation plan for this region and the TIP conform to the SIP. The Project is included in the TIP. In addition, the Commonwealth of Massachusetts has adopted *Transportation Project Guidelines* for reviewing highway projects, and applied these Guidelines to the Project.

The Central Artery/Tunnel Project as a whole has completed the NEPA process and conforms to the SIP by virtue of its inclusion in the TIP. None of the the three new design alternatives, including the Preferred Alternative, represents a significant change in Project design, concept, and scope; therefore, a new conformity determination is not required. As a policy matter, FHWA considers the Project "grandfathered" under the Interim and Final Conformity Rules.

Nonetheless, independent of these considerations, in order to demonstrate that the Project continues to "eliminate or reduce the severity and number of violations of the NAAQS and achieve the expeditious attainment of such standards," a revised detailed air quality analysis was conducted. This analysis verifies that there will continue to be no predicted microscale violations and that the Preferred Alternative results in lower mesoscale emissions than those estimated under the previously approved Scheme Z.

The analysis of the selected Charles River Crossing alternative verifies that:

- The Project would not cause or contribute to new violations of the NAAQS.

The microscale analysis indicated that there would be no violations of the NAAQS for the years 2001 and 2010 for the Preferred Alternative or Scheme Z. In addition, CO concentrations in both 2001 and 2010 are estimated to become lower (improve) at more locations than they are estimated to become higher with the Preferred Alternative as compared with conditions under Scheme Z. Also, no violations of any air quality standards are predicted as a result of pollutants released from any proposed ventilation building.

- The Project would not interfere with timely attainment or required emission reductions towards attainment.

The areawide (mesoscale) analysis shows decreases in emissions of CO, NO_x, and VOCs with the Preferred Alternative when compared with conditions under Scheme Z for both 2001 and 2010, and when compared with 1990 base emission levels.

In summary (see Table 4.21), the air quality analysis conducted establishes that the Preferred Alternative considered in this FSEIS/R conforms with the requirements of the 1990 CAAA.

4.3.6 Mitigation Measures

The Preferred Alternative will not cause or contribute to new violations of State or Federal AAQS or interfere with the "timely attainment or required emission reductions towards attainment." Accordingly, no additional measures are required to mitigate potential air quality effects.

4.4 NOISE AND VIBRATION

This chapter describes the current noise and vibration levels in the Area North of Causeway Street and presents the noise and vibration impacts of the two designs: the Preferred Alternative and Scheme Z. Existing ambient noise was monitored at 20 sites. Future noise levels for the two designs at all of the 20 sites were predicted using FHWA STAMINA 2.0 traffic noise model. Predicted noise levels for the Preferred Alternative are compared with existing noise levels; with year 2010 Scheme Z baseline noise levels; and with the FHWA criteria for the applicable land use category (see Figure 4.23 and Tables 4.22 through 4.24).

Existing ground vibration levels were determined at representative sensitive structures and future vibration levels for the Preferred Alternative and Scheme Z were projected based on future traffic conditions (see Figure 4.24 and Table 4.25). Where estimated future noise and vibration impacts are likely to occur, mitigation measures are proposed. Stationary noise sources for the proposed ventilation building have been assessed for potential impacts as well. This building will be designed and built to be consistent with the Boston noise ordinance and the relevant DEP regulations.

4.4.1 Noise

4.4.1(a) Affected Environment

The basic unit employed to describe existing and future noise levels in the Project area is the A-weighted decibel (dBA). Detailed information on the dBA scale, the methodology used for obtaining existing and future noise levels in dBA, and the selection of criteria to assess future noise impacts are contained in the 1991 Projectwide FSEIS/R and in its Noise and Vibration Appendix.

Noise-sensitive land uses in the area include residences, one educational institution, a county jail, and fairly extensive waterfront recreation areas. Existing noise levels at these locations are generally dominated by noise generated by motor vehicles on nearby major roads and local streets. Noise monitoring sites were selected to provide a uniform coverage of the Project area and include all land uses, including future residential land uses.

Ambient noise measurements were made during April and May 1993 at the 20 selected sites during peak morning (7:00 AM to 10:00 AM) and peak afternoon (4:00 PM to 7:00 PM) traffic hours (see Figure 4.23). Leq (1 hour) noise levels recorded at these 20 sites during those time periods are provided in Tables 4.22 through 4.24.

Results of the noise measurement program indicate hourly morning Leqs ranging from 61 dBA to 73 dBA and hourly afternoon Leqs ranging from 62 dBA to 73 dBA. Such levels are typical of a daytime urban environment; these measurements exclude noise from aircraft sources.

4.4.1(b) Impacts

Traffic noise impacts were assessed at each of the 20 receptor sites by comparing the predicted noise levels of the Preferred Alternative with existing noise levels, with year 2010 Scheme Z levels, and with the FHWA noise criteria for the applicable land use category.

The impact assessment using FHWA Noise Abatement Criteria (NAC) follows the procedure outlined in 23 CFR 772. Impacts occur when the predicted traffic noise levels approach or exceed the NAC, or when the predicted traffic noise levels substantially exceed the existing noise levels. MHD has determined that a category "B" site approaches 67 dBA when the measured or predicted noise level is 66 dBA. In addition, a substantial increase in noise levels for highway projects in Massachusetts is defined as a 15-dBA increase over existing noise levels.

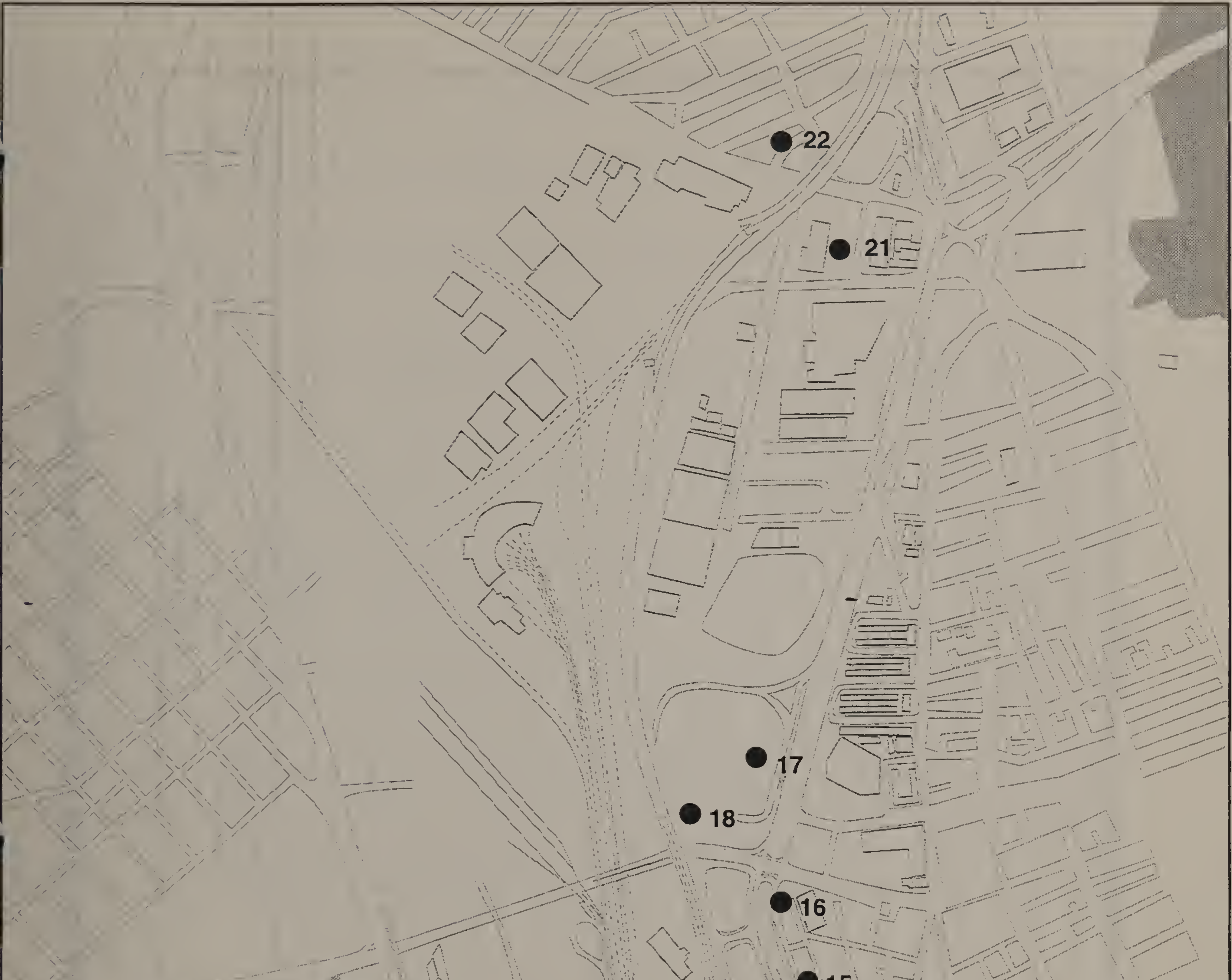
All of the noise receptor sites have been renumbered since the 1991 FSEIS/R to provide a sequential list of sites in the area (see Figure 4.24 for the locations of the sites and Tables 4.22 through 4.24 for the data). For purposes of comparison old site numbers reported in the 1991 FSEIS/R are also shown alongside the new site numbers.

Comparison With Existing Noise Levels. For impact assessment based on comparing future Project levels with existing levels, the following impact classifications are used:

Impact Classification	Increase Over Existing Level
No Impact	less than 5 dBA
Minor Impact	6 to 10 dBA
Moderate Impact	11 to 15 dBA
Substantial Impact	more than 15 dBA

(Consistent with 1991 FSEIS/R procedures, the above impact classifications are based on an average of several state impact classifications reported in *Highway Traffic Noise in the United States - Problem and Response*, FHWA, April 1986, revised November 1990. The above classifications appear to be the most accepted definitions by the states and FHWA.)

Preferred Alternative. For the Preferred Alternative,


22
21
17
18
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19
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12
13
14
5
8
6
4
11
10
9
7
3
2
1
0
200
400
600
800
1000 FEET

FIGURE

4.23

Noise Monitoring And Prediction Sites

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Table 4.22

COMPARISON OF PREDICTED NOISE LEVELS IN 2010 WITH 1993 EXISTING LEVELS FOR SCHEME Z

Site No.	Site Description	In Leq (1 hour) dba						Noise Abatement To Be Considered
		1993 Existing		Scheme Z		Change over Existing		
		AM	PM	AM	PM	AM	PM	
1 (27)	Charles River Building	68	67	66	68	-2	1	No
2 (28)	Paul Revere Landing Park South	69	69	68	70	-1	1	No
3 (42)	South bank-near Charles River Dam	71	68	76	77	5	9	Yes
4 (40)	Walkways adjoining MBTA baseule bridge	68	69	76	76	8	7	Yes
5 (43)	Spaulding Rehabilitation Hospital-riverside benches	62	65	69	69	7	4	Yes
6	Suffolk County Jail	67	66	72	71	5	5	Yes
7	Residential building at Amy Court and Martha Way	69	69	72	71	3	2	No
8 (29A)	Leverett Circle at pedestrian walkway	73	70	72	72	-1	2	No
9 (29B)	Residental apartment building near outdoor health club swimming pool	64	63	61	61	-3	-2	No
10 (18)	Paul Revere Landing Park North	69	65	68	69	-1	4	No
11 (41)	North bank-near Charles River Dam	67	70	73	75	6	5	Yes
12 (44)	Site of proposed pedestrian bridge overpass near railroad tracks	66	67	72	73	6	6	Yes
13 (17)	Edward Everett House on Harvard Street	66	64	73	76	7	12	Yes
14 (45)	Residential buildings on Main Street-near Court House	63	63	73	74	10	11	Yes
15 (46)	Residential area along Rutherford Avenue	73	71	75	75	2	4	No
16	Residential area adjacent to Rutherford Avenue	71	70	74	73	3	3	No
17	Bunker Hill Community College-area along Rutherford Avenue	72	73	75	73	3	0	No
18 (47)	Bunker Hill Community College-rear entrance adjacent to train station	70	69	71	72	1	3	No
19	Industrial Park-site of proposed residential development	69	68	76	76	7	8	Yes
20 (39)	North Point-near proposed residential development area	61	62	68	69	7	7	Yes
21	40 Cambridge Street/Spice St.	75	72	77	73	2	1	No
22	6 Perkins Street	66	70	68	72	2	2	No

( ) Denotes site numbers in 1991 FSEIS/R

Source: Bechtel/Parsons Brinckerhoff

Table 4.23

COMPARISON OF PREDICTED NOISE LEVELS IN 2010 WITH 1993 EXISTING LEVELS FOR THE PREFERRED ALTERNATIVE

Site No.	Site Description	In Leq (1 hour) dba						Noise Abatement To Be Considered
		Existing		Preferred Alternative		Change over Existing		
		AM	PM	AM	PM	AM	PM	
1 (27)	Charles River Building	68	67	66	69	-2	2	No
2 (28)	Paul Revere Landing Park South	69	69	68	70	-1	1	No
3 (42)	South bank-near Charles River Dam	71	68	72	72	1	4	No
4 (40)	Walkways adjoining MBTA bascule bridge	68	69	72	73	4	4	No
5 (43)	Spaulding Rehabilitation Hospital-riverside benches	62	65	68	68	6	3	Yes
6	Suffolk County Jail	67	66	67	67	0	1	No
7	Residential building at Amy Court and Martha Way	69	69	71	70	2	1	No
8 (29A)	Leverett Circle at pedestrian walkway	73	70	71	72	-2	2	No
9 (29B)	Residental apartment building near outdoor health club swimming pool	64	63	61	61	-3	-2	No
10(18)	Paul Revere Landing Park North	69	65	68	69	-1	4	No
11(41)	North bank-near Charles River Dam	67	70	69	72	2	2	No
12(44)	Site of proposed pedestrian bridge overpass near railroad tracks	66	67	65	66	-1	-1	No
13(17)	Edward Everett House on Harvard Street	66	64	71	73	5	9	Yes
14(45)	Residential buildings on Main Street-near Court House	63	63	73	72	10	9	Yes
15(46)	Residential area along Rutherford Avenue	73	71	72	72	-1	1	No
16	Residential area adjacent to Rutherford Avenue	71	70	73	71	2	1	No
17	Bunker Hill Community College-area along Rutherford Avenue	72	73	72	71	0	-2	No
18(47)	Bunker Hill Community College-rear entrance adjacent to train station	70	69	69	73	-1	4	No
19	Industrial Park-site of proposed residential development	69	68	68	70	-1	2	No
20(39)	North Point-near proposed residential development area	61	62	67	68	6	6	Yes
21	40 Cambridge Street/Spice Street	75	72	77	73	2	1	No
22	6 Perkins Street	66	70	69	72	3	2	No

( ) Denotes site numbers in 1991 FSEIS/R

Source: Bechtel/Parsons Brinckerhoff

Table 4.24

COMPARISON OF PREDICTED NOISE LEVELS IN 2010 WITH 1993 EXISTING LEVELS, SCHEME Z AND THE PREFERRED ALTERNATIVE WITH THE FHWA NAC *

Site No.	Site Description	In Leq (1 hour) dba										Noise Abatement To Be Considered
		1993 Existing		Preferred Alternative		Scheme Z		Preferred Alternative Over Scheme Z		Preferred Alternnative Over NAC		
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
1 (27)	Charles River Building	68	67	66	69	66	68	0	1	0	3	Yes
2 (28)	Paul Revere Landing Park South	69	69	68	70	68	70	0	0	2	4	Yes
3 (42)	South bank-near Charles River Dam	71	68	72	72	76	77	-4	-5	6	6	Yes
4 (40)	Walkways adjoining MBTA bascule bridge	68	69	72	73	76	76	-4	-3	6	7	Yes
5 (43)	Spaulding Rehabilitation Hospital-riverside benches	62	65	68	68	69	69	-1	-1	2	2	Yes
6	Suffolk County Jail	67	66	67	67	72	71	-5	-4	1	1	Yes
7	Residential building at Amy Court and Martha Way	69	69	71	70	72	71	-1	-1	5	4	Yes
8 (29A)	Leverett Circle at pedestrian walkway	73	70	71	72	72	72	-1	0	5	6	Yes
9 (29B)	Residental apartment building near outdoor health club swimming pool	64	63	61	61	61	61	0	0	-5	-5	No
10 (18)	Paul Revere Landing Park North	69	65	68	69	68	69	0	0	2	3	Yes
11 (41)	North bank-near Charles River Dam	67	70	69	72	73	75	-4	-3	3	6	Yes
12 (44)	Site of proposed pedestrian bridge overpass near railroad tracks	66	67	65	66	72	73	-7	-7	-1	0	Yes
13 (17)	Edward Everett House on Harvard Street	66	64	71	73	73	76	-2	-3	5	7	Yes
14 (45)	Residential buildings on Main Street-near Court House	63	63	73	72	73	74	0	-2	7	6	Yes
15 (46)	Residential atea along Rutherford Avenue	73	71	72	72	75	75	-3	-3	6	6	Yes
16	Residential area adjacent to Rutherford Avenue	71	70	73	71	74	73	-1	-2	7	5	Yes
17	Bunker Hill Community College-area along Rutherford Avenue	72	73	72	71	75	73	-3	-2	6	5	Yes
18 (47)	Bunker Hill Community College-rear entrance adjacent to train station	70	69	69	73	71	72	-2	1	3	7	Yes
19	Industrial Park-site of proposed residential development	69	68	68	70	76	76	-8	-6	2	4	Yes
20	North Point-hear proposed residential development area	61	62	67	68	68	69	-1	-1	1	2	Yes
21 (39)	40 Cambridge Street/Spice Street	75	72	77	73	77	73	0	0	11	7	Yes
22	6 Perkins Street	66	70	68	72	69	72	1	0	3	6	Yes

* Noise Abatement Criteria (for category B sites is Leq (1 hour)= 66 dBA or more)

( ) Denotes site numbers in 1991 FSEIS/R

Source: Bechtel/Parsons Brinckerhoff

decreases in noise levels of 1 to 3 dBA are estimated at two sites (9 and 12). At 14 sites noise level increases of up to 5 dBA over existing noise levels are estimated. Noise level increases of more than 5 dBA are estimated at four sites (5, 13, 14, and 20), the largest increase of 10 dBA occurring at site 14 during the AM peak period. Since the future noise levels do not increase by more than 10 dBA, no moderate or substantial impacts are predicted at any of the 20 sites during both AM and PM peak periods.

Comparison With FHWA Criteria: Noise levels with the Preferred Alternative will approach or exceed the FHWA outdoor NAC of Leq (1 hour) = 67 dBA (category B sites) at 19 of the 20 sites. Future Scheme Z noise levels will also exceed the FHWA criterion at the same 19 out of the 20 sites. The existing noise levels currently approach or exceed the FHWA criterion at 16 out of the 20 sites. The affected sites include existing and proposed residential land uses and extensive waterfront recreational areas. Since there are no sites with moderate or substantial impact under MHD definition, only sites that approach or exceed the NAC are assessed for noise reduction strategies.

Comparison With Scheme Z Noise Levels: Predicted future 2010 Scheme Z noise levels are compared with estimates of projected noise levels under the Preferred Alternative; the results are presented in Table 4.24. A comparison of noise levels under future baseline conditions with the noise levels for the Preferred Alternative shows that a large number of sites would experience decreases in noise levels under the Preferred Alternative: 15 sites during the AM and the PM periods. One site would experience no change in noise levels, and four sites would experience increases in noise levels for the Preferred Alternative compared to future baseline conditions. In all of these four cases the increases are approximately 1 dBA. Since the Project area is uniformly covered by noise receptor sites, this type of analysis leads to the following meaningful conclusion. Compared to Scheme Z, the Preferred Alternative would have considerably less noise impact.

Ventilation Noise Levels: Noise from the proposed ventilation building in the Preferred Alternative will result only from operation of the fans used for tunnel supply air and exhaust. The amount of noise generated by such fans depends on the number and type of fans, their sizes and air volume flow rates, the pressure drop across the fans, and the operating efficiency of the fans. The resulting level of fan noise at any noise-sensitive receptor in the community will further depend on the specific design configuration of the ventilation duct system, the control equipment designed for the fans, and the distance and orientation of the ventilation building air intake and exhaust openings relative to the given receptor position. (See the 1991 FSEIS/R Noise and Vibration Appendix for details of ventilation building noise prediction methodology.)

Under Scheme Z there is no ventilation building in the Area North of Causeway Street because there are no tunnel sections. One ventilation building will be required for the Preferred Alternative and is constructed below grade, with exhaust and air intake stacks above grade. The ventilation building and associated equipment will be designed to meet the Project Design Criteria which are detailed in the 1991 FSEIS/R and which are consistent with the City of Boston Code, Ordinances, Title 7, Section 50.

Preliminary assessment of noise from the ventilation building (specifically from fans and ducting) without sound attenuation measures include the following results (see Table 4.26). No violations of the DEP noise criterion (i.e., an increase of 10 dBA or more over ambient levels) will occur at the future residential sites in the North Point area, either during daytime or nighttime. Property line noise levels will be determined at the design phase when more specific information on fan noise levels will be available.

Ventilation building noise levels will satisfy the DEP criterion of not exceeding the existing ambient noise levels by more than 10 dBA during both daytime and nighttime.

4.4.1(c) Mitigation Measures: Noise

An area or land use must be considered for noise abatement if the predicted traffic-related noise levels either approach or exceed the FHWA NAC or substantially exceed the existing noise levels. Either of these two conditions represents a noise impact. Abatement measures are to be considered to the extent reasonable opportunities exist to control noise. Abatement analysis follows the procedures outlined in 23 CFR 772. A discussion of various options to control Project-related traffic noise is provided in the 1991 FSEIS/R; the discussion concludes that the only reasonable abatement measure would consist of erecting noise barriers within the right-of-way.

Noise Barrier Analysis. Noise barriers have been considered where the total projected traffic noise levels approach or exceed the FHWA NAC at all sites with external use except at site 9 where there will be no noise impact under either alternative. Where feasible and reasonable, noise barriers have been recommended.

Recommendations made in the 1991 FSEIS/R are valid for the Preferred Alternative and Scheme Z for all of the receptor sites. In addition to the noise barriers that were recommended at sites 13, 14, 15, and 18 in the 1991 FSEIS/R, a noise barrier has been considered at one new site (site 17).

At receptor site 17 (Bunker Hill Community College), noise levels under the Preferred Alternative would be 6 to 9 dBA above FHWA NAC levels. This site represents a school and sports use and would need mitigation. A 13- to 15-dBA noise reduction would be achieved at receptor site 17 with a 1,240-foot-long by 14-foot-tall barrier. At an estimated cost of $295,120 this barrier would be feasible and reasonable and is recommended.

Since the DSEIS/R, traffic noise impacts at two additional sensitive (residential) sites were analyzed (sites 21 and 22; see Tables 4.22 through 4.24). At receptor site 21 (40 Cambridge Street), noise levels under the Preferred Alternative would be within 3 dBA of the existing noise levels. The existing and Preferred Alternative noise levels would exceed the FHWA NAC for residential land uses. Since the residences are located directly on the streets, constructing a noise barrier at this site would block access to the houses and, therefore, it is neither reasonable nor feasible. A noise barrier is not recommended at this site.

Receptor site 22 (6 Perkins Street) represents residential land uses nearer to the relocated Ramp C-L. Backyards of these residences directly face railroad tracks, (which are a distance of about 75 feet away) and I-93 (which is a distance of about 200 feet away). At this site, the existing and the Preferred Alternative traffic noise levels would be 11 dBA above FHWA NAC levels. Mitigation has been considered at this site. Obtaining a substantial noise reduction as required by 23 CFR 772 at this site would require the construction of either a 700-foot-long and more than 25-foot-tall noise barrier along backyards of the residences, or two 1,000-foot-long structural barriers, one each on two levels of the viaducts. Even with the construction of these barriers, the noise reduction achieved at the affected residences would be 3 to 6 dBA. Both options are not feasible and, therefore, a noise barrier is not recommended at site 22. Impacts of the Preferred Alternative are virtually identical to noise generated by Scheme Z.

It is recommended that noise mitigation be studied further as part of the design process and mitigation implementation process. Construction of the recommended noise barrier will be reviewed and a decision will be made during the design phase with input from DEP and affected residents of Charlestown.

4.4.2 Vibration

4.4.2(a) Affected Environment

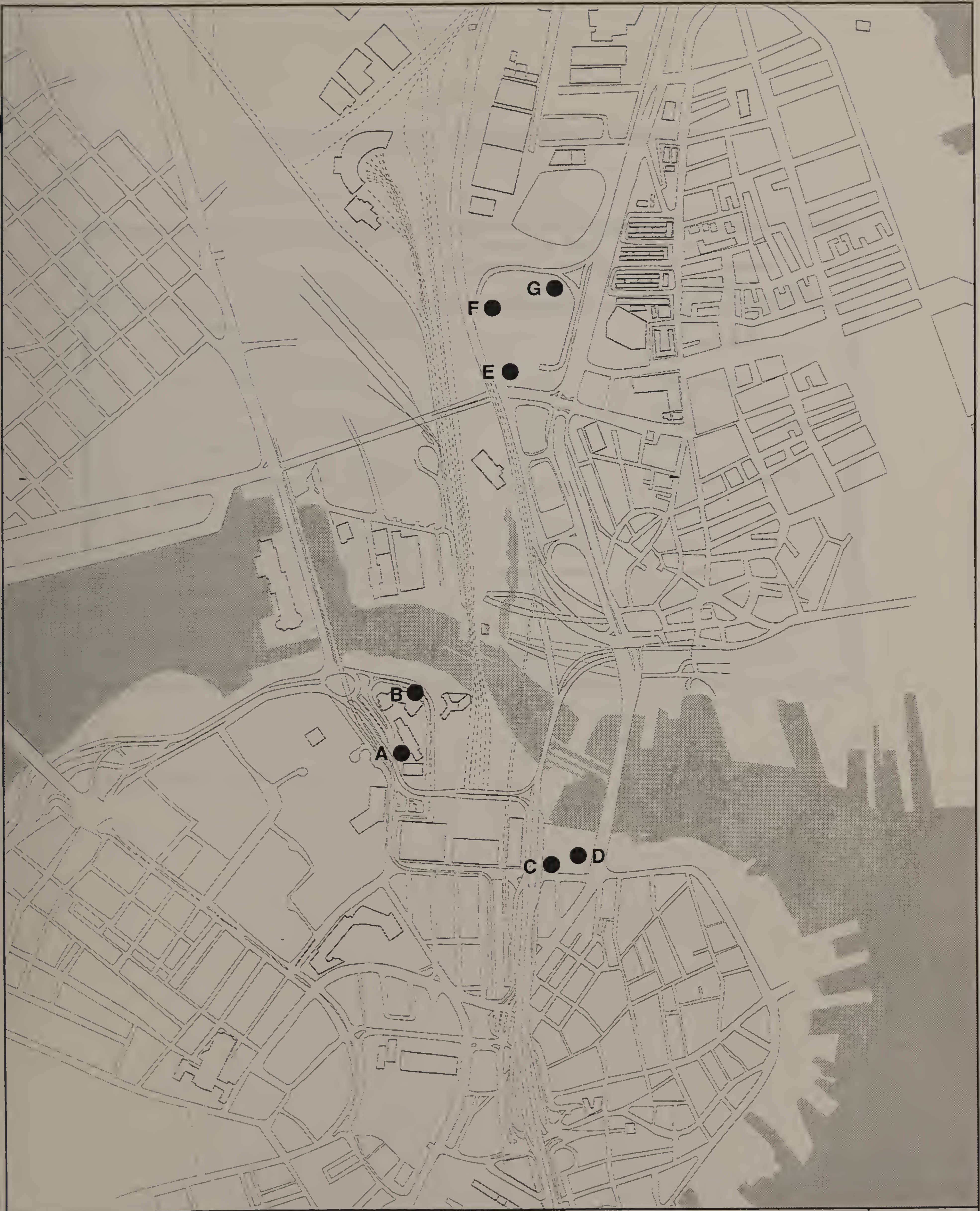
Vibration-sensitive land uses in the Project area include residential, commercial, institutional, and industrial buildings. The potential effects of vibration at such locations include structural damage, annoyance to building occupants, and/or interference with sensitive manufacturing processes. These concerns will be greater during the construction phase than during the operations phase of the Project (see Section 5.9).

Existing Vibration Levels. The basic unit used in measuring vibration levels is the vibration velocity in in/sec. Detailed information on the methodology to obtain vibration levels and criteria used for assessing vibration impacts is presented in the 1991 FSEIS/R and in its Noise and Vibration Appendix. Vibration measurements were made during April 1993 to document the existing vibration levels at seven locations (see Figure 4.24 for vibration monitoring sites). Descriptions of these locations and the measured peak vibration velocities are presented in Table 4.26.

Results of the vibration measurement program indicate that the existing vibration levels are in the range of 0.001 to 0.025 in/sec. These velocities are just within the perceptible range, and are caused principally by motor vehicles on adjacent roads. Higher vibration levels measured in the industrial facilities are due to machinery operating within the facilities.

4.4.2(b) Impacts

The severity of vibration effects is assessed by comparing anticipated long-term vibration levels at sensitive receptors with existing vibration levels and with project vibration criteria. The vibration velocity levels that would



FIGURE

4.24

Vibration Monitoring Sites

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 800 1000 FEET

Table 4.25

SUMMARY OF EXISTING VIBRATION MEASUREMENTS

Site	Description	Range of Peak Vibration Velocity (in/sec)	Major Vibration Source
A	100 Nashua Street, south entrance to loading dock	0.002	Leverett Circle, on-ramp traffic
B	Suffolk County Jail basement	0.001	Nashua Street
C	Charles River building south end, basement level	0.002	Off-ramp to Storrow Drive
D	131 Beverly Street, SW corner of buildings	0.003	Off-ramp to Storrow Drive
E	Bunker Hill Community College mechanical room buildings	0.001-0.0032	Traffic on I-93
F	Recycling center, 440 Rutherford Ave. Charlestown	0.015	Trucks on weigh scales
G	Publishing house, 440 Rutherford Ave.	0.018-0.025	Printing machines

Source: Bechtel/Parsons Brinckerhoff

cause minor architectural damage are in the range of 0.12 in/sec for historic structures and 0.2 in/sec for nonhistoric structures. Typically, a heavy truck passing by will generate a velocity level in the range of 0.003 in/sec, considerably lower than the damage criterion of 0.12 in/sec. As a result, future traffic vibrations will not cause any damage to historic and nonhistoric structures.

Traffic-induced vibration could be annoying to people inside buildings. Effects of traffic vibration are assessed based on the maximum amplitude of vibration caused by a single vehicle rather on traffic volumes. Typically, vehicles at 50 feet generate vibration velocities in the range of 0.001 in/sec for automobiles to 0.003 in/sec for heavy trucks. The criteria for annoyance and disruption of sensitive equipment are in the range of 0.005 in/sec for hospitals and 0.04 in/sec for factories. These levels are higher than the vehicle-generated levels and they will not be exceeded by the operation of any of the three alternatives.

4.4.2(c) Mitigation Measures: Vibration

Based on the above analyses, no mitigation measures are required.

4.5 AQUATIC RESOURCES IMPACTS

This section describes the impacts caused by the Preferred Alternative and Scheme Z on wetlands and waterways resources under the jurisdiction of State And Federal agencies. Both the Preferred Alternative and Scheme Z affect navigation of the Lower Charles River Basin, and aquatic resource areas including fisheries, water quality, and other floodplains as described in this section. Because of these impacts, MHD has coordinated extensively with Federal, State, and local agency personnel through the Water Resources Subcommittee (WRS) of the Project's Interagency Coordinating Committee. During this coordination period, USACE made a preliminary determination that the Non-River Tunnel Alternative constitutes the least environmentally damaging practicable alternative under its regulations. This Subcommittee was convened by MHD so that agency concerns and regulatory responsibilities could be coordinated and considered early in the design and planning process. The WRS consists of members of the Project team and representatives of regulatory agencies which have authority to comment and review, issue concurrence, or issue permits for Project activities which affect either coastal or inland water resources.

In November 1992, MHD, in coordination with the WRS, prepared the Projectwide Wetlands and Waterways Mitigation Program (PWWMP), which includes evaluation of wetlands and waterways resources for all Project subareas except for the Area North of Causeway Street. Following the MEPA review process for this FSEIS/R, the PWWMP will be amended to include the mitigation for the the Area North of Causeway Street as described in Chapter 6.

Four major regulatory programs exercise jurisdiction in the Charles and Millers Rivers. The Federal Clean Water Act and its implementing regulations control the placement of fill in waters of the United States, including associated wetland areas. Section 10 of the Rivers and Harbors Act controls the placement of structures in navigable waters of the United States. The purposes of these programs are to ensure the ecological integrity of the nation's wetlands, protect and improve the quality of water resources, and ensure safe and adequate navigation.

The State Wetlands Protection Act and implementing regulations govern activities proposed within 100 feet of inland and coastal wetland resources. The regulations recognize the role of wetland resources in the protection of public and private water supply, groundwater supply, land containing shellfish, fisheries, and wildlife habitat; the prevention of pollution and storm damage; and flood control. The protection of these interests is achieved through the implementation of performance standards.

The State Chapter 91 program implementing regulations exercise jurisdiction over activities proposed in filled and flowed tidelands. The waterways program is designed to promote and protect tidelands as a locus for water-dependent activities; provide pedestrian access along the waterfront and enhance public use and enjoyment of these areas; protect Areas of Critical Environmental Concern (ACEC) and ecologically significant areas from the impact of filling and structures; support the revitalization of urban waterfronts in a manner that promotes public use and enjoyment; and encourage the coordination of local and State planning for the waterfront land use.

This section and Section 5.10.1 compare the permanent and temporary construction period effects of the two designs on the aquatic resources and provide the factual analysis relating to applicable standards for each of these regulatory programs.

The following sections describe the permanent impacts and mitigation of the Preferred Alternative and Scheme Z on the aquatic resources by ecological factors and by individual regulatory program. Summaries of wetlands impacts are found at the end of Sections 4.5.1 and 4.5.2.

4.5.1 Federal Wetlands

Affected Environment. The study area includes the portion of the Charles River upstream of the existing MDC dam and downstream of the old Charles River Dam (now the location of the Museum of Science and the O'Brien Highway) as well as the adjacent Millers River (see Figure 4.25). The surrounding area is highly developed and urbanized, being occupied mostly by transportation and industrial uses. In the Charles River, the riverbanks consist mostly of vertical seawalls and sloped rubble or riprap banks, and in the Millers River they are steep, and consist of mud and silt, rubble, and stone riprap. Vegetation along both rivers is minimal; it is limited to narrow bands of successional weed species along portions of the riverbanks. Land adjacent to the Charles and Millers Rivers is highly disturbed and public access to the area is limited. The Millers River has poor water quality.

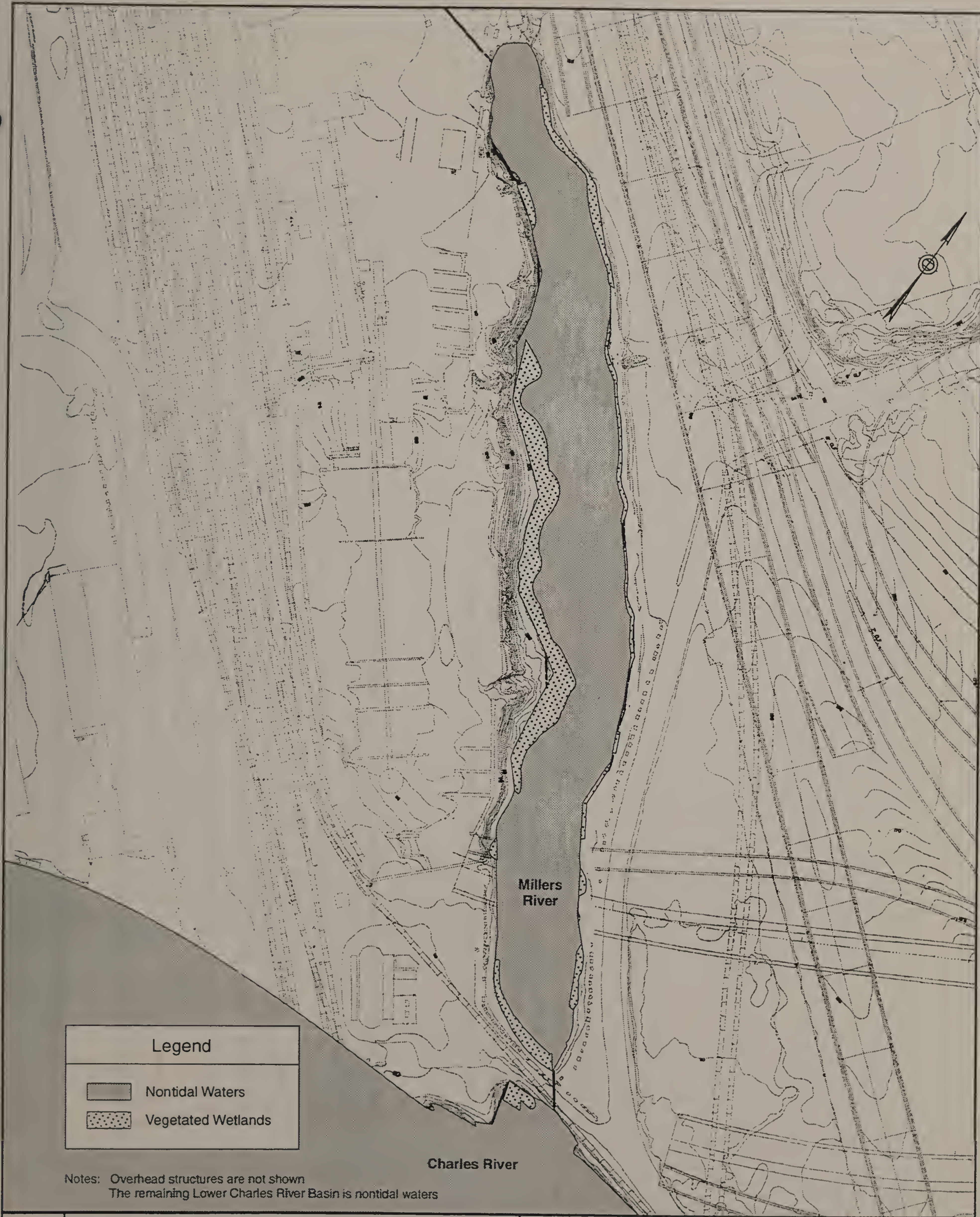
Methodology. Federal jurisdiction in inland areas includes nontidal waters up to the ordinary high water mark and, where present, any adjacent wetlands, which are designated as a "special aquatic site" as defined under Section 404 Regulations. The boundary of nontidal waters was delineated by including all land under water extending to ordinary high water (el. 103.0). Wetland boundaries were established in the field during preparation of the 1991 FSEIS/R using the Federal "three-parameter" method that includes vegetation, soil, and hydrology (FICWD 1989). This delineation was based on assumed soils and hydrology. The area was field checked in the fall of 1993 and the boundaries were updated using the 1987 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* as a guide. Borings and transects revealed that the previous delineation included upland areas which did not have sufficient hydrology to support wetland species. The boundary was revised with the concurrence of USACE and the upland limit of positive hydrology was established at elevation 103.5. This results in a total inventory of 9,120 sf of Federal wetlands.

The Charles River and the Millers River are inland water bodies which were formerly tidal and are now separated from the Boston Harbor coastal waters by a USACE-constructed dam and lock system installed in 1978. The Millers River is connected to the Charles River by two 84-inch culverts located approximately 900 feet upstream of the MDC dam/flood control pumping station. Because of its hydraulic connection to the Charles River, the water levels and other hydrologic and hydrographic conditions in the Millers River are controlled by the conditions in the Charles River. There is no surface connection between the Charles and Millers Rivers.

The Millers River is nearly surrounded by a narrow band (1 foot to 5 feet wide) of wetlands as defined by Federal regulations. The boundary of the wetlands was established at an elevation of 103.5 in 1993. Approximately 9,000 sf of Federally defined wetlands surround the Millers River. The dominant plant of these wetlands is common reed, *Phragmites australis,* an introduced plant with little wildlife habitat value. Approximately 120 sf of wetlands dominated by indigo bush, *Amorpha fruticosa*, Yellow Iris and Seaside Goldenrod are found on a portion of the banks of the Charles River near its confluence with the Millers River. These resource areas are shown in Figure 4.25.

Wetlands Functions And Values: The existing functions and values of the affected areas of the Charles River and the Millers River have been evaluated twice. In the first evaluation, performed for the 1991 FSEIS/R, the functions and values of these aquatic habitats were evaluated using a methodology based on the Wetlands Evaluation Technique (WET 1.0 and 2.0) that was developed by Adamus, et al (1987). During the development of the subsequent PWWMP, the evaluation method was further refined to address agency comments and concerns about the suitability of those methods in identifying ecological values and to include State wetland functions. That process, the ecological approach, identified the following aquatic functions that nontidal waters and wetlands could potentially perform:

- groundwater recharge
- nutrient export
- groundwater discharge
- aquatic diversity/abundance
- groundwater supply
- flood storage and desynchronization
- fish habitat
- sediment and shoreline stabilization


Millers River
Charles River
Legend
▨ Nontidal Waters
▩ Vegetated Wetlands

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE 4.25

Federal Aquatic Resource Areas

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 125 250 FEET

Table 4.26

PREDICTED VENTILATION BUILDING 8 NOISE IMPACT NEAR SELECTED LAND USES (PREFERRED ALTERNATIVE)

Adjacent And Other Nearby Land Uses			Fan Noise Levels (dBA)				Ambient Noise Levels (dBA)		Increase Over Ambient Noise Levels (dBA)			
			Day		Night		Day	Night	Day		Night	
Description	Land Use	Approx. Distance	Exhaus	Supply	Exhaus	Supply	L90	L90	Exhaus	Supply	Exhaus	Supply
Suffolk County Jail	Institution	300	56	53	51	48	60	50	-4	-7	1	-2
Registry building	Office	200	60	57	55	52	60	50	0	-3	5	2

Notes:

1. Daytime exhaust conditions are based on emergency ventilation airflow.
2. Daytime supply conditions are based on maximum normal ventilation airflow.
3. Nighttime supply and exhaust conditions are based on 37 percent of maximum normal ventilation airflow.
4. Results presented do not include sound attenuation measures.
5. L90 means noise level will be exceeded 90 percent of the time.
6. Nighttime ambients are assumed to be 10 dBA below daytime ambient levels.

Source: Bechtel/Parsons Brinckerhoff

- wildlife habitat
- nutrient retention and transformation
- endangered species
- surface water supply
- sediment/toxicant retention

The value of these functions for the Charles River and the Millers River was then determined using this methodology. The analysis found that not all of the biological or chemical functions listed above perform at the highest level in either river. In some cases, they are performed poorly or not at all. For example, groundwater supply and surface water supply are nonfunctioning in both water bodies. Similarly, the natural flood storage and desynchronization function of both water bodies is non-functional. While the Charles River provides an artificially controlled flood storage function, the water level of the river is controlled by the dam; thus it provides no "natural" flood control.

Because of the degraded overall quality of the aquatic resources, the presence of the Charles River Dam, and highway and railroad bridges in this area, there are a limited number of aquatic functions performed by these water bodies.

Disturbance from adjacent industrial land uses, poor water quality, and low-quality vegetation severely limit wildlife habitat suitability. The Charles River, because it contains fish, may serve as a feeding area for cormorants, which have been observed in the area. The Millers River has low significance as a wildlife habitat (see Wildlife Habitat Evaluation, Appendix D, Exhibit 2). Currently, there is almost no means of access by wildlife, except birds, to the Charles River and the adjacent Millers River, as the rivers and their narrow fringes of vegetation are entirely surrounded by industrial land.

Under the ecological approach methodology developed in conjunction with the Water Resource Subcommittee agencies, those functions which a water body or wetland perform well are termed principal valuable functions (PVF). PVFs include only those functions and values that display a significance in any of the identified resources during existing baseline conditions. Significance was determined by the agencies to include only those functions and values that received ratings of high or moderate during the evaluation of functions and values (see Appendix D, Exhibit 1). Those functions and values that were rated low or nonfunctional are not included as PVFs. Based on those evaluations, the PVFs are as follows:

Charles River

- sediment and shoreline stabilization
- sediment/toxicant retention
- nutrient retention and transformation
- fish habitat

Millers River

- sediment/toxicant retention
- nutrient retention and transformation

Description Of Proposed Work. The permanent impacts evaluated in this FSEIS/R are based on a conceptual design; therefore, it is not known where the exact location of piers, viaducts, tunnels, or at-grade ramps will be. Permanent impacts are shown in Table 4.27 and shown in Figures 4.26 through 4.29.

The Preferred Alternative places two piers, one pylon, and a portion of a footing which affects a total of 0.10 acre of nontidal water in the Charles River (see Figure 4.27). This design also places bridge piers and fill in the Millers River for access ramps, displacing a total of 1.1 acres of nontidal waters and approximately 0.08 acre of wetlands.

Scheme Z affects 0.10 acre of nontidal waters in the Charles River due to the placement of piers. This design also results in minor impacts to wetlands in the Millers River due to the placement of piers which displace less than 0.002 acre of wetlands and 0.01 acre of nontidal waters.

Under both the Preferred Alternative and Scheme Z, indirect loss of some wetlands may result from the shading impacts of viaducts over the Millers River. The Preferred Alternative and Scheme Z remove the existing I-93 piers (except for Pier A, the reverse banana pier) which currently occupy 0.06 acre of nontidal waters.

Impacts. This section assesses impacts on PVFs. The Preferred Alternative and Scheme Z result in some direct loss of nontidal waters and wetlands. However, the effects of these impacts on the PVFs in each water body are insignificant, as explained below.

Sediment And Shoreline Stabilization: Banks in the Charles River which will be temporarily affected by pier placement from both designs will be reconstructed with riprap and will continue to protect the shoreline from erosive currents (winds and boat wake) after construction. Therefore, under both the Preferred Alternative and Scheme Z, none of the permanent alterations in the Charles River creates adverse impacts on sediment and shoreline stabilization. Banks in the Millers River will be lost as a result of filling activities under the Preferred Alternative. However, the proposed fill in the river will be contained with a riprap bank which will be constructed and designed to provide sediment and shoreline protection.

Sediment/Toxicant Retention: The ability of the Millers River to function as a detention basin for area runoff, erosion, and sedimentation, and its ability to provide sediment/toxicant retention potentially could be decreased as a result of reduction in the surface area of the river for both the Preferred Alternative and Scheme Z. The existing I-93 drainage, which currently drains directly into the Millers River, will be diverted to a location east of the Charles River Dam. This will reduce the amount of stormwater runoff and its attendant pollutant loading entering the Millers River approximately by half, thereby maintaining the ability of the Millers River to provide this function.

Nutrient Retention And Transformation: The Charles and Millers Rivers provide this function in a similar manner to sediment/toxicant retention and will function similarly as described in the Sediment/Toxicant Retention paragraph above.

Fish Habitat: Neither design results in permanent impacts to the Charles River fisheries. Fish habitat is not a PVF for the Millers River (see Section 4.5.5, Fisheries).

404(b)(1) Regulatory Analysis. Since the Preferred Alternative and Scheme Z involve dredging and filling in the Charles River and in the Millers River, an application for a permit to conduct these activities has been submitted to USACE pursuant to Section 404 of the Clean Water Act. As a part of its review of the permit application, USACE will apply guidelines published at 40 CFR Part 230, usually referred to as 404(b)(1) Guidelines. The purpose of these Guidelines is "to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material." A Section 404 permit cannot be issued by USACE unless it is determined that the proposed activities comply with these Guidelines. The Guidelines prohibit discharges of dredged or fill material into Federally regulated waters and wetlands where practicable alternatives exist which have less adverse impact on the aquatic ecosystem and which do not have other significant adverse environmental consequences. Accordingly, USACE will evaluate the alternatives with respect to their impacts on the aquatic ecosystem. Such impacts are described briefly below. For the complete analysis, see Appendix C.

Effects On Aquatic Ecosystem Characteristics. The Guidelines require an analysis of the potential short-term and long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, biological, and human use components of the aquatic ecosystem as described in Subparts C through F of the Guidelines. These components include the following characteristics of the aquatic ecosystem:

(1) Physical and Chemical Characteristics (Subpart C)
  - substrate
  - suspended particulates/turbidity
  - water
  - current patterns and water circulation
  - normal water fluctuations
  - salinity gradients

(2) Biological Characteristics (Subpart D)
  - threatened and endangered species
  - fish, crustaceans, mollusks, and other aquatic organisms in the food web
  - other wildlife

(3) Special Aquatic Sites (Subpart E)
  - sanctuaries and refuges
  - wetlands
  - mudflats
  - vegetated shallows
  - coral reefs
  - riffle and pool complexes

(4) Human Use Characteristics (Subpart F)

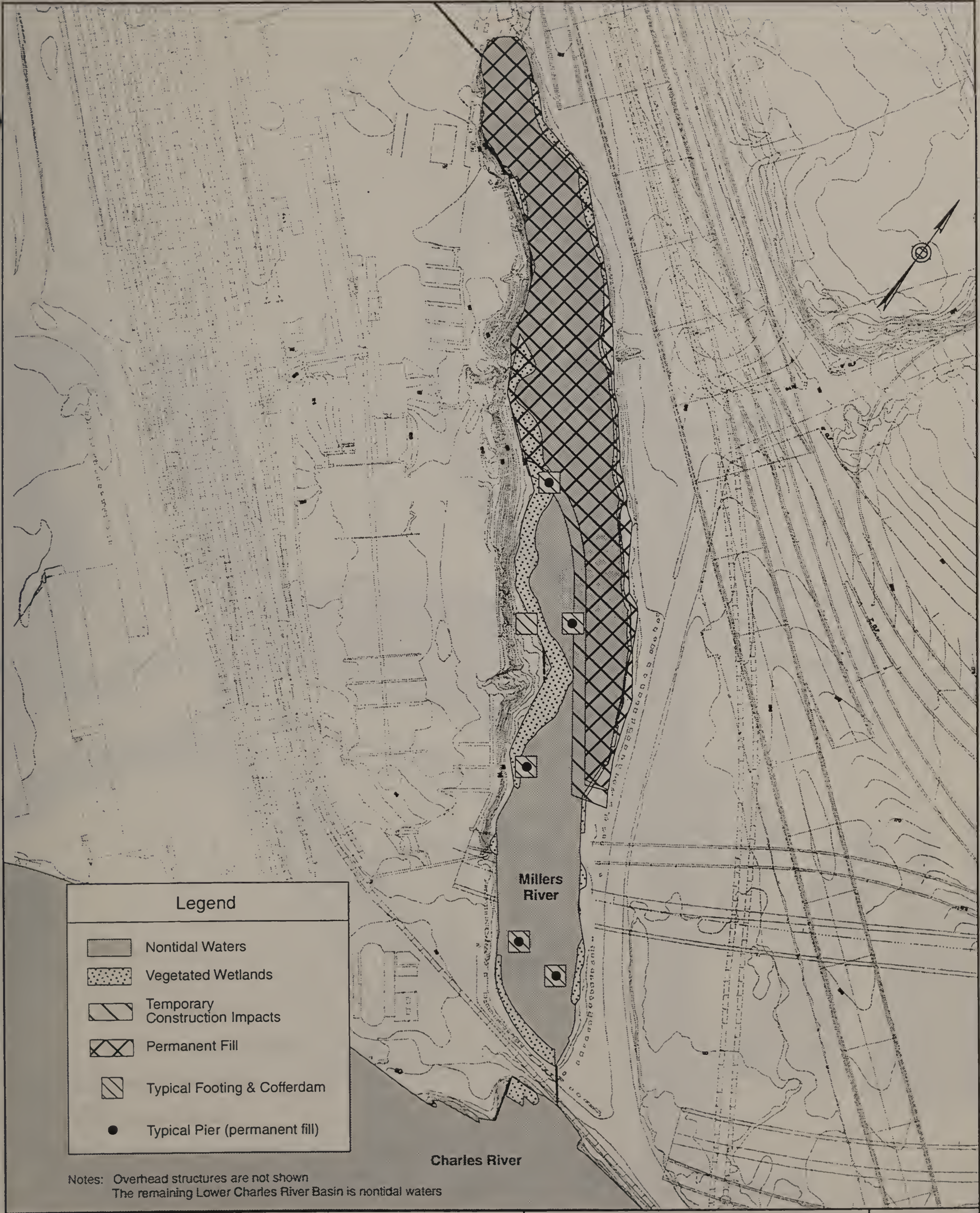
Table 4.27

PERMANENT IMPACTS TO FEDERAL WETLAND RESOURCE AREAS

	Preferred Alternative	Scheme Z[1]
Charles River		
nontidal water (acres)	0.10	0.10
wetlands (acres)	0.00	0.00
Millers River		
nontidal water (acres)	1.10	0.01
wetlands (acres)	0.08	0.002

1. The impacts have been recalculated to reflect current pier dimensions and construction methods for the Millers River, this differing from those included in the 1991 FSEIS/R.

Source: Bechtel/Parsons Brinckerhoff


Millers River
Charles River
Legend
Nontidal Waters
Vegetated Wetlands
Temporary Construction Impacts
Permanent Fill
Typical Footing & Cofferdam
Typical Pier (permanent fill)

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

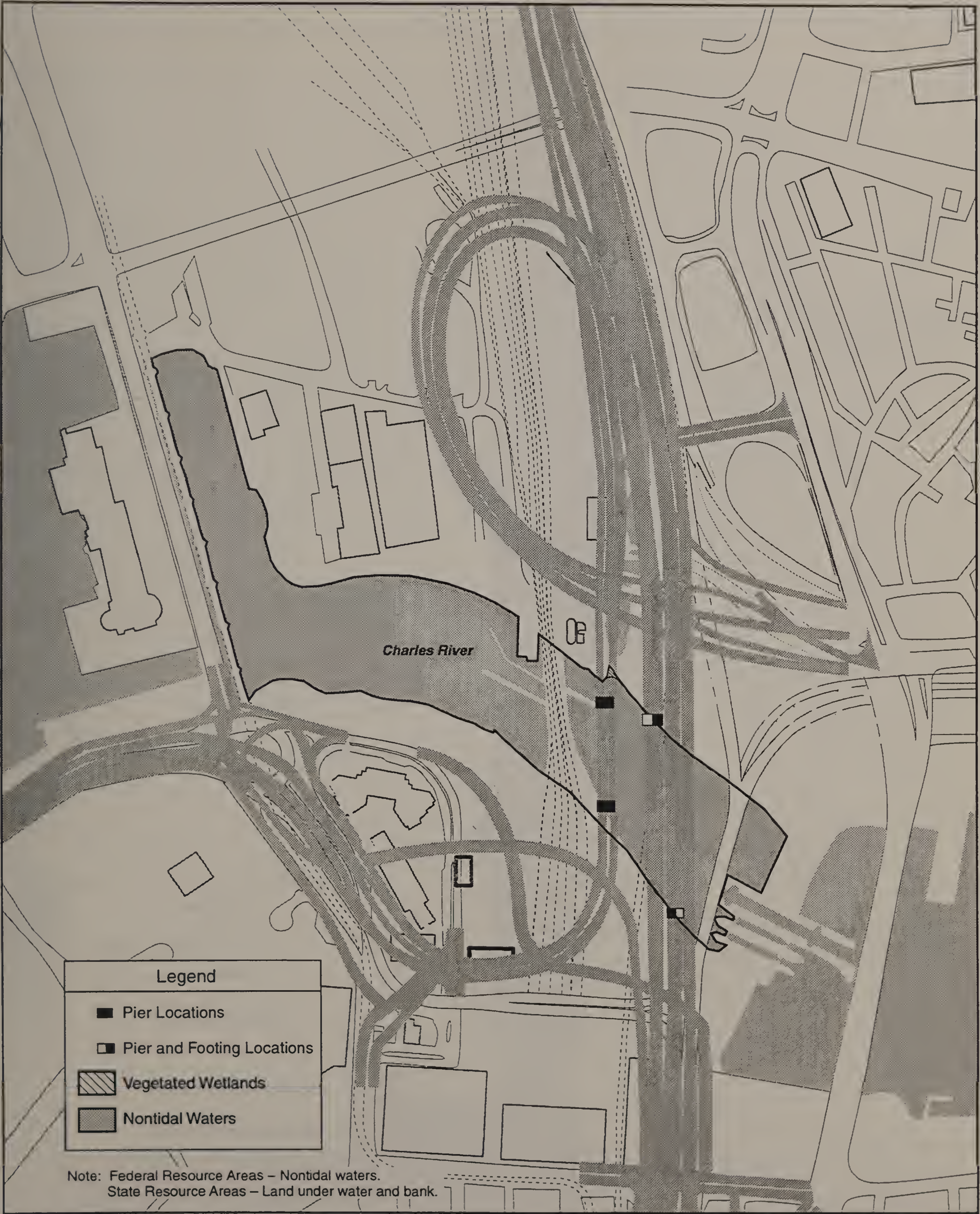
FIGURE 4.26

Affected Federal Aquatic Resource Areas; Millers River: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 125 250 FEET


Charles River
Legend
▬ Pier Locations
◧ Pier and Footing Locations
▨ Vegetated Wetlands
▩ Nontidal Waters

Note: Federal Resource Areas – Nontidal waters.
State Resource Areas – Land under water and bank.

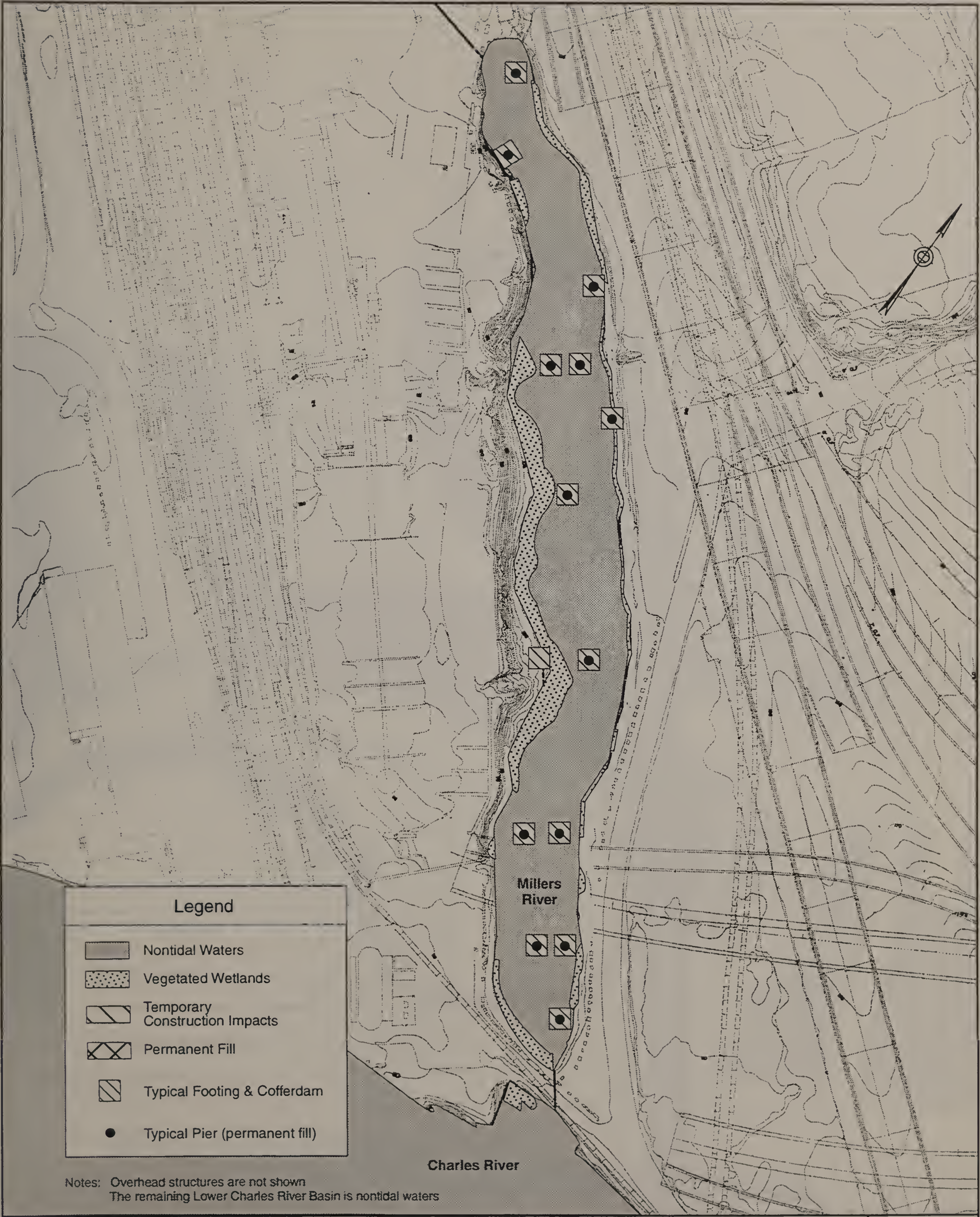
FIGURE 4.27

Affected Aquatic Resource Areas; Charles River: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 FEET


Millers River
Charles River
Legend
▨ Nontidal Waters
▨ Vegetated Wetlands
▧ Temporary Construction Impacts
☒ Permanent Fill
▧ Typical Footing & Cofferdam
● Typical Pier (permanent fill)

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE

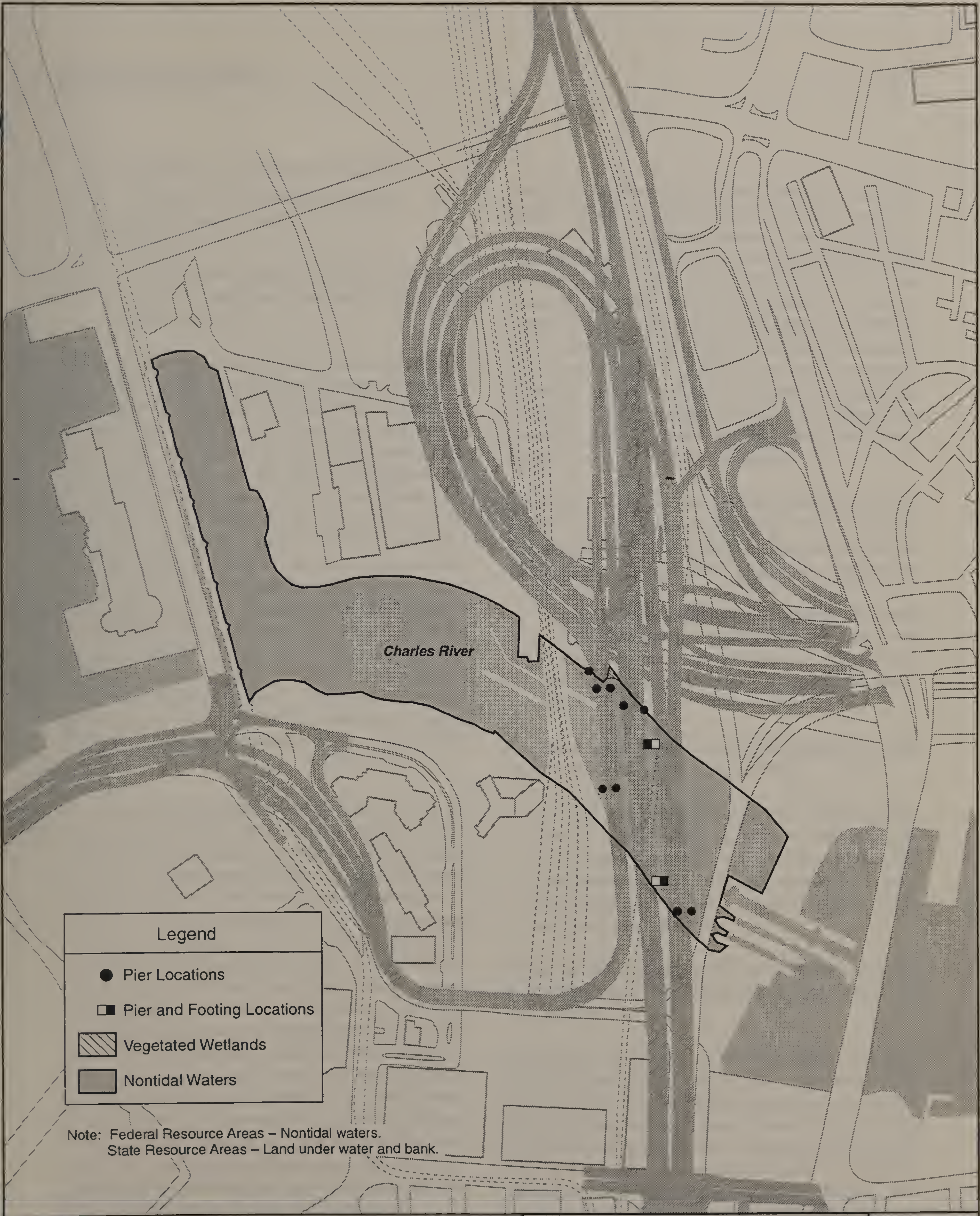
4.28

Affected Federal Aquatic Resource Areas; Millers River: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 125 250 FEET


Charles River
Legend
● Pier Locations
◧ Pier and Footing Locations
▨ Vegetated Wetlands
■ Nontidal Waters
Note: Federal Resource Areas – Nontidal waters.
State Resource Areas – Land under water and bank.

FIGURE

4.29

Affected Aquatic Resources Areas;
Charles River:
Scheme Z
Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 FEET

- municipal and private water supplies
- recreational and commercial fisheries
- water-related recreation
- aesthetics
- parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves

The potential effects, both permanent and temporary, on each of the aquatic ecosystem characteristics resulting from the Preferred Alternative and Scheme Z are detailed in Appendix C. That analysis found that some characteristics were not present in the affected area of the Charles or Millers River. The Charles and Millers Rivers are freshwater systems which, in the affected area, do not have salinity gradients, mudflats, any sanctuaries or refuges, coral reefs, vegetated shallows, municipal or private water supplies, or national or historic preserves. Nor do the areas provide habitat for threatened or endangered species. The disposal of dredged material from the entire Central Artery/Tunnel Project at the Massachusetts Bay Disposal Site (MBDS) was the subject of a biological opinion by the National Marine Fisheries Service (NMFS) in 1991. NMFS concluded that disposal would not jeopardize the continued existence of any threatened or endangered species under NMFS jurisdiction.

The remaining characteristics are affected to some degree by the Preferred Alternative and Scheme Z. The Preferred Alternative has two bridges and fill for access ramps which affect approximately 1.2 acres of waters of the United States. This results in potential effects on suspended particulates/turbidity, water, current patterns and water circulation, normal water fluctuations, fish and other aquatic organisms in the food web, wildlife, wetlands, recreational and commercial fisheries, water-related recreation, aesthetics, and parklands. The bridges also shade the Charles River and the Millers River which could result in additional wetlands losses. Scheme Z with its two bridges has a total permanent effect on approximately 0.11 acre of waters of the United States. A detailed analysis is contained in Appendix C. Scheme Z, due to its larger bridges and loop ramps on the north side of the river, has greater potential long-term aesthetic effects on parklands and open space than the Preferred Alternative (see Section 4(f) Evaluation).

Summary Of Federal Wetlands Impacts. The Preferred Alternative and Scheme Z have minimal long-term impacts to Federal aquatic resources in the Charles River. While Scheme Z results in 0.01 acre of nontidal waters and 0.002 acre of wetlands in the Millers River, the Preferred Alternative results in the fill of 1.1 acres of nontidal waters and 0.08 acre of wetlands in the Millers River. However, these activities will have an insignificant impact to the PVFs of the Charles River and the Millers River (see Appendix D, Exhibit 1). In addition, filling of 1.1 acres of nontidal waters in the Millers River permits a greater setback of the loop ramps and viaduct from the north bank of the Charles River.

Executive Order 11990. Federal Executive Order 11990, issued by President Carter in 1970, pertains to wetlands protection and requires that agency actions should, to the extent possible, result in the avoidance of:

> "...long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever this is a practicable alternative."

The Order further requires that certain findings be made by the head of the agency taking action:

> "Prior to approving actions for new construction located in wetlands, findings must be made that there is no practical alternative to such construction and that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use."

In making such findings, the Order allows agency heads to consider economic, environmental, and other pertinent factors.

There are no practicable alternatives which avoid wetlands. Wetlands impacts have been minimized to the greatest extent possible. The Project proposes mitigation for all permanent adverse impacts to wetlands in the Millers River. Permanent impact to inland wetlands in the Charles River have been avoided. Due to the nature of the Project, waterways must be crossed by bridges. The areas surrounding the proposed waterways crossing con-

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[1] See endnotes for Section 4.5, Aquatic Resources, at the end Chapter 4.

tain many constraints, including an existing subway tunnel, railroad bridges and tracks, highways, and other structures.

The impacts to wetlands in the Millers River allows ramps to be set back 120 feet from the banks of the Charles River, thereby improving the parkland benefits of the project.

Based upon the above considerations, it is determined that there is no practicable alternative to the proposed construction in wetlands and the Preferred Alternative includes all practicable measures to minimize harm to wetlands which may result from such use.

4.5.2 State Wetlands

Affected Environment. The State inland wetland resource areas located in and adjacent to the Charles and Millers Rivers include: banks; bordering vegetated wetlands (BVW); land under water bodies and waterways (LUW); and bordering land subject to flooding (BLSF) (see Figures 4.30 and 4.31). The Charles River also contains an anadromous fish run (a coastal wetland resource area). The October 15, 1993, MEPA certificate requested MHD to consider whether the impacts of proposed CANA mitigation and purported wetlands violations in the Millers River by others should be considered in determining baseline conditions in the affected environment. However, the analysis is based on existing conditions.

The outstanding mitigation commitments pertain to the CANA project. The vast majority of that project included in the Chapter 91 license, as originally designed, will be redesigned under the new crossing. For those portions which are complete, adequate mitigation has been implemented and has been assumed to be in place as part of the existing conditions. In relation to purported wetlands violations, while the Millers River may be subject to environmental stress for a variety of reasons, MHD is not in a position to make determinations concerning the legality of previous or ongoing activities which may be affecting the resource values of either the Charles or Millers River.

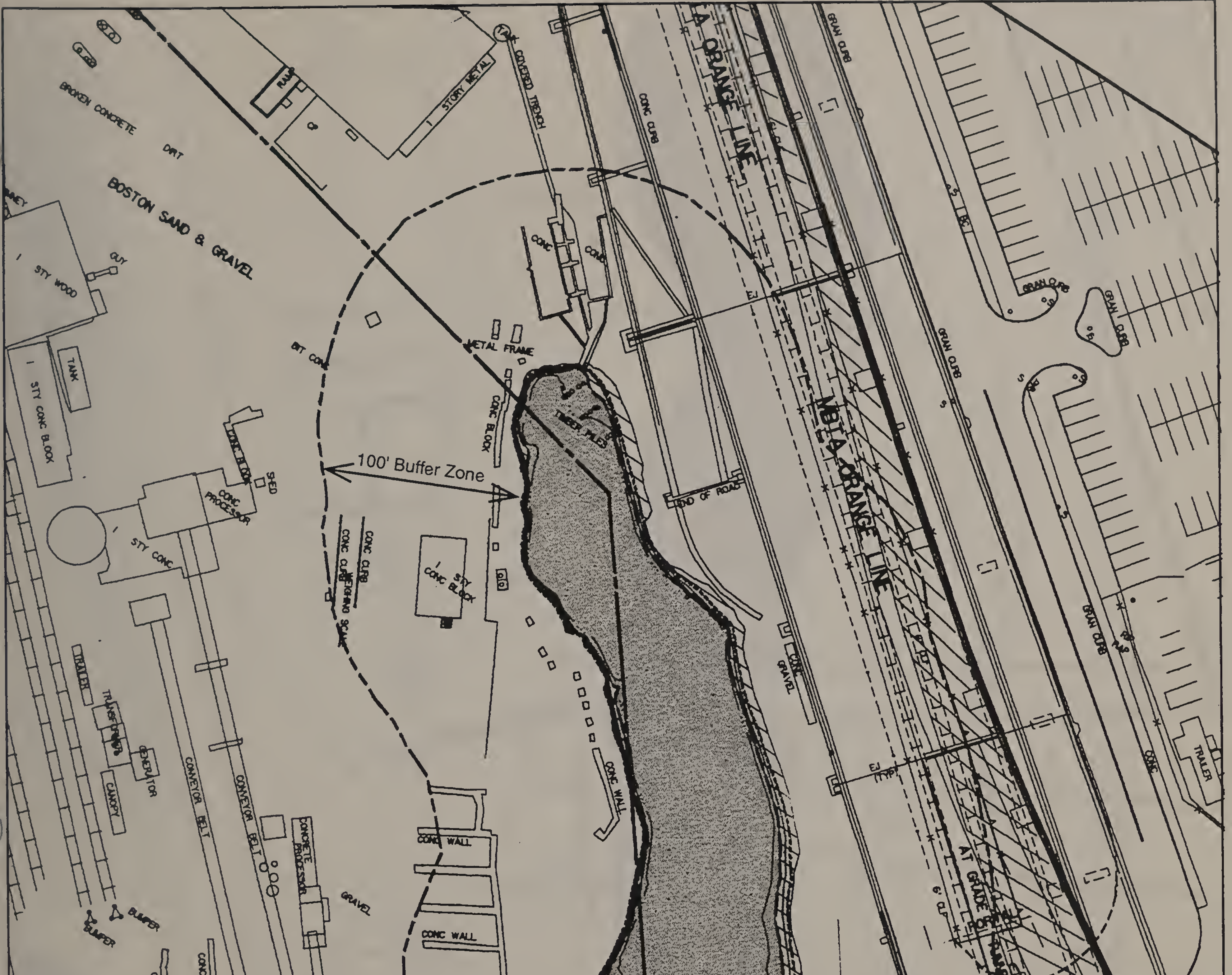
Methodology. The State wetlands resource areas are delineated in accordance with the definitions as outlined in 310 CMR 10.00 and, except for BVW, generally according to elevation (see Appendix D for a more detailed description of the methodology). There are very little BVW surrounding the Millers River. The 1993 DSEIS/R identified three small, isolated areas of BVW on the west side and southern tip of the Millers River. Those areas were delineated as BVW because they contained over 50 percent wetland vegetation, were low and flat, and had annually saturated soils. The wetland vegetation is dominated by reed grass. Interdispersion is low, which is typical of disturbed situations. In response to the Secretary's Certificate on the DSEIS/R these areas were reviewed with DEP Division of Wetlands staff, representatives from the Cambridge Conservation Commission, and the City of Boston Environment Department (BED).

For the reasons described in detail in Appendix D, these areas were delineated increasing the amount of BVW resource area from 180 sf to approximately 2,800 sf. No BVW are found along the Charles River. In both rivers[1] the top of the bank (el. 103.5 mean annual flood level) is less than midway up the steep slopes of the rivers and BLSF occurs as a narrow band between elevation 103.5 and 104.3, or 0.8 foot.

Presumptions Of Significance.
Bordering Vegetated Wetland: BVW are likely to be significant to public or private water supply, groundwater supply, flood control, storm damage prevention, prevention of pollution, and protection of fisheries and wildlife habitat. In the case of the Millers River BVW, the presumptions of significance apply only for the prevention of pollution (see Appendix D). There are no BVW in the Charles River.

Banks: Banks are presumed to be significant to public or private water supply, to groundwater supply, to flood control, to storm damage prevention, to the prevention of pollution, and to the protection of fisheries and wildlife habitat. The banks in the Millers River are significant to the prevention of pollution only. Banks in the Charles River are significant to the prevention of pollution and to the protection of fisheries habitat (see Appendix D).

Land Under Water Bodies And Waterways: LUW is likely to be significant to public and private water supply, to groundwater supply, to flood control, to storm damage prevention, to prevention of pollution, and to protection of fisheries and wildlife habitat. LUW in the Millers River is significant to the prevention of pollution only. LUW in the Charles River is significant to the preven-


Legend
Land Under Water
Bank
Bordering Land Subject to Flooding
Bordering Vegetated Wetlands
100' Buffer Zone
Elev. 104.3'
Elev. 103.5'
Elev. 102.4'
MILLERS RIVER
MILLERS RIVER
MBTA ORANGE LINE
MBTA ORANGE LINE
BOSTON SAND & GRAVEL
BROKEN CONCRETE
DIRT
CONVEYOR BELT
CONVEYOR BELT
CONC WALL
CONC PROCESSOR
CONCRETE PROCESSOR
STY CONC
STY CONC BLOCK
STY WOOD
TANK
TRAILER
TRANSFORMER
GENERATOR
CANOPY
BUMPER
GRAVEL
METAL SHED
METAL FRAME
TIMBER PILES
CONC BLOCK
SHED
COVERED TRENCH
1 STORY METAL
END OF ROAD
GRAN CURB
CONC CURB
AT GRADE PORTAL
BUFFER ZONE
PARKING
UNDER CONSTRUCTION
BIT CONC
EJ (TYP)

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE

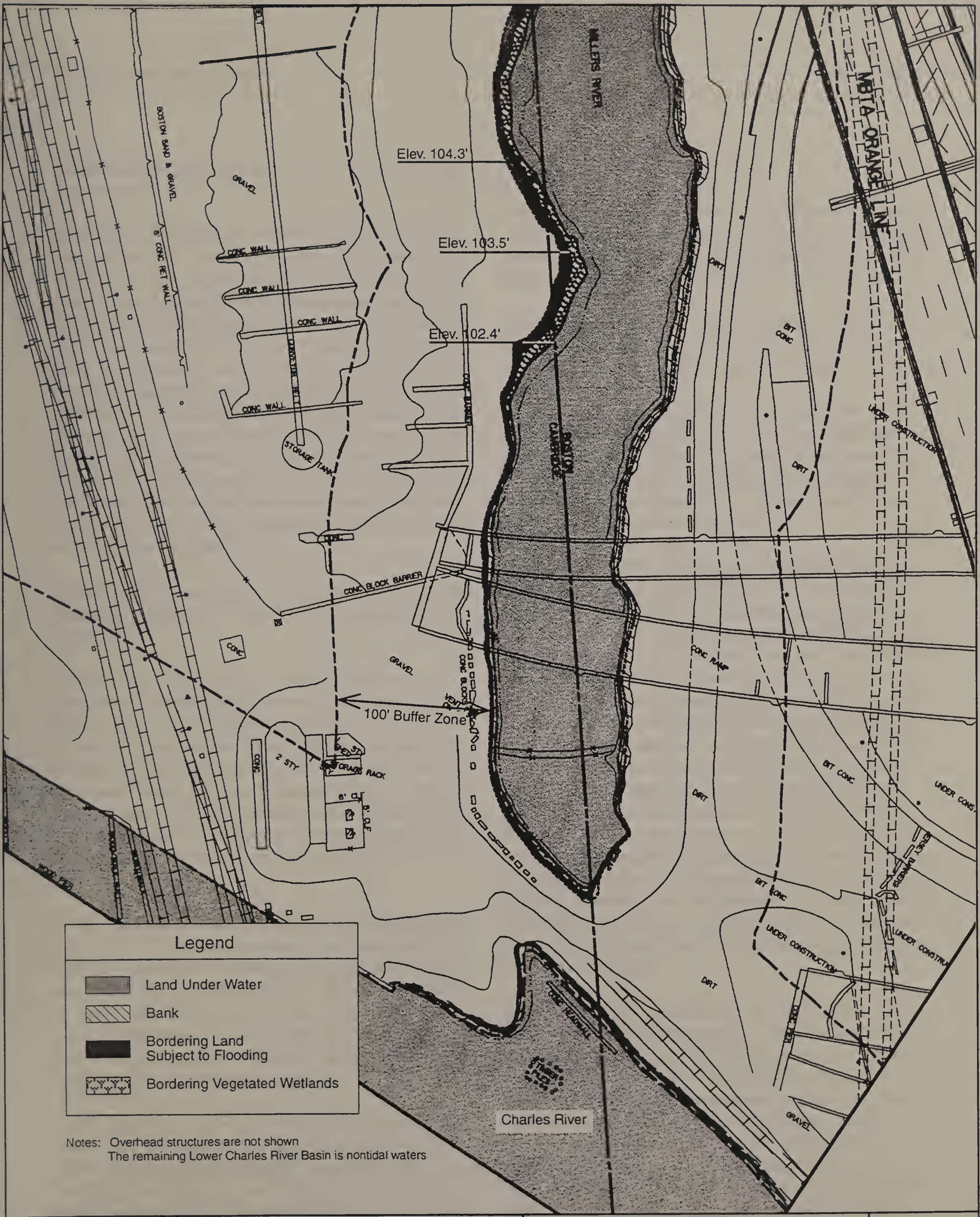
4.30

State Wetlands Resource Areas

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 80 160 FEET


MILLERS RIVER
MBTA ORANGE LINE
BOSTON SAND & GRAVEL
6' CONC RET WALL
GRAVEL
CONC WALL
CONC WALL
CONC WALL
CONC WALL
STORAGE TANK
Elev. 104.3'
Elev. 103.5'
Elev. 102.4'
BOSTON
CAMBRIDGE
CONC
CONC BLOCK BARRIER
CONC
GRAVEL
CONC BLOCKS
VENT
100' Buffer Zone
2 STY
STORAGE RACK
6' CLF
DIRT
BIT CONC
UNDER CONSTRUCTION
DIRT
CONC RAMP
BIT CONC
DIRT
UNDER CONST.
BIT CONC
UNDER CONSTRUCTION
DIRT
UNDER CONSTRUCTION
GRAVEL
WOOD PIER
CONC HEADWALL
TIMBER PILES
Charles River
Legend
▩ Land Under Water
▨ Bank
■ Bordering Land Subject to Flooding
Bordering Vegetated Wetlands

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE 4.31 State Wetlands Resource Areas

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 80 160 FEET

tion of pollution and to the protection of fisheries habitat (see Appendix D).

Bordering Land Subject To Flooding: BLSF is likely to be significant to flood control and storm damage prevention; however, because the water levels in the Charles River and the Millers River are controlled by the existing MDC dam, the water bodies have no function in terms of providing natural flood control. Because the Charles River is confined by vertical seawalls in this area and surrounding terrain is low and flat, it can be argued that while there is a theoretical flood storage capacity within the confines of the banks, there is no BLSF resource (see Appendix D). Although the Millers River has a constricted outlet and can store stormwaters, the presence of the Charles River Dam and basin overrides any flood storage/storm damage protection functional value in the Millers River (see Appendix D).

Impacts. The impacts to each wetlands resource area by alternative are shown in Table 4.28 and described as follows:

Banks: In the Charles River, both alternatives result in minor alterations to the bank from the installation of bridge piers, 75 lf for the Preferred Alternative and 10 lf for Scheme Z. In the Millers River, Scheme Z affects 60 lf of bank as a result of pier placement and the Preferred Alternative results in a loss of approximately 1,180 lf of bank because of fill in and along the Millers River for an at-grade intersection. However, approximately 350 lf of bank will be reconstructed in conjunction with the fill.

BVW: Under the Preferred Alternative, approximately 870 sf of BVW is lost as a result of the proposed piers and fill. In addition, construction impacts to the small area of BVW just south of this area result in the loss of an additional 435 sf of BVW for a total loss of 0.03 acre. Under Scheme Z approximately 350 sf of BVW will be lost. Any losses of BVW will be replicated in accordance with applicable regulations.

LUW: Impacts to LUW are associated with pier placement. The Preferred Alternative (see Figure 4.27) involves the placement of two piers, one pylon, and a portion of a pylon footing in the Charles River, resulting in the displacement of 0.10 acre of LUW. This design also places five piers and fill for access ramps in the Millers River, which results in the displacement of 1.1 acres of LUW (see Figures 4.32 and 4.33).

Scheme Z (see Figures 4.34 and 4.35) places 11 piers in the Charles River, resulting in a loss of 0.10 acre of resource area. The placement of 13 piers results in the displacement of 0.01 acre of LUW in the Millers River.

The Preferred Alternative and Scheme Z remove the existing I-93 piers, except for Pier A, the reverse banana pier, which currently occupy 0.06 acre of LUW.

BLSF: BLSF in the Charles and Millers Rivers is not significant to flood storage/storm damage protection; thus, any impact in this resource area has only a theoretical impact. Nevertheless, calculations were performed to determine the theoretical loss of flood storage in the Charles and Millers Rivers (see Table 4.28).

Conformance With Performance Standards. The Certificate issued by the Secretary of Environmental Affairs on the 1990 DSEIS/R concludes that the three crossings[2] proposed by the Project are water dependent. The October 1993 MEPA Certificate requested that MHD reexamine the issue of water dependency. In doing so, the Secretary of Enviornmental Affaires stated: "...any structure or part of the project that was part of Scheme Z, including structures that are "ancillary" to the actual crossing facility in the same or a similar manner as they were in Scheme Z are water dependent."[3] The Certificate further states that nonwater-dependent uses which share a function with a water-dependent use are to be determined water dependent.[4] Appendix D provides an analysis of the determination of water dependency. This conclusion has a bearing on the application of performance standards in inland wetland regulations. For the reasons set forth in Appendix D, all portions of the Project are water dependent.

Section 10.53(3)(l) establishes water-dependent uses as limited projects in inland wetlands. For limited projects of this type, performance standards for resource areas apply as follows: any portion of such work which alters a BVW must comply with the governing regulations; if any other resource area is found to be significant to flood control or prevention of storm damage, the performance standards must be met for those interests; and, finally, adverse impacts from such work in any other resource area shall be minimized in relation to the statutory interests for which that resource area is found to be significant.

BVW: The performance standards for BVW apply only to the interest of prevention of pollution as discussed in Appendix D. The only significant function performed by the BVW is the prevention of pollution. However, as part of the mitigation program for this Project subarea, a water feature will be built to the west of the railroad tracks in the same drainage basin as the Millers River. The water feature will replicate the lost BVW with wetland vegetation in a low and flat location in the presence of hydrology. Therefore, the replicated BVW will meet the performance standard of prevention of pollution.

LUW: The technical performance standards do not apply; rather, the applicable regulation requires minimization of impacts. Nevertheless, under both designs, the Project impacts have been minimized to the greatest extent possible. Under Scheme Z the number of piers were reduced in the Charles River. Under the Preferred Alternative, the number of piers has been further reduced, and while fill is being placed in the Millers River the amount of fill has been minimized as much as possible. Under the Preferred Alternative, the removal of the existing I-93 piers[5] and 300 sf of piles supporting the old railroad trestle will actually reduce the impact of LUW. No permanent adverse impact to anadromous fish in the Charles River is expected. The significance of this resource area for flood control or prevention of storm damage has been rebutted; therefore, the performance standards do not apply (see Appendix D).

Banks: The significance of this resource area for flood control or prevention of storm damage has been rebutted; therefore, the technical performance standards do not apply (see Appendix D).

BLSF: The significance of this resource area for flood control or prevention of storm damage has been rebutted; therefore, the performance standards do not apply (see Appendix D). Nevertheless, the proposed placement of piers in the Charles River or fill in the Millers River will not restrict flows in a manner which will increase flood stage or velocity. The existing banana pier will remain in the Charles River to retain its hydrodynamic function in regard to the MDC dam turbine system.

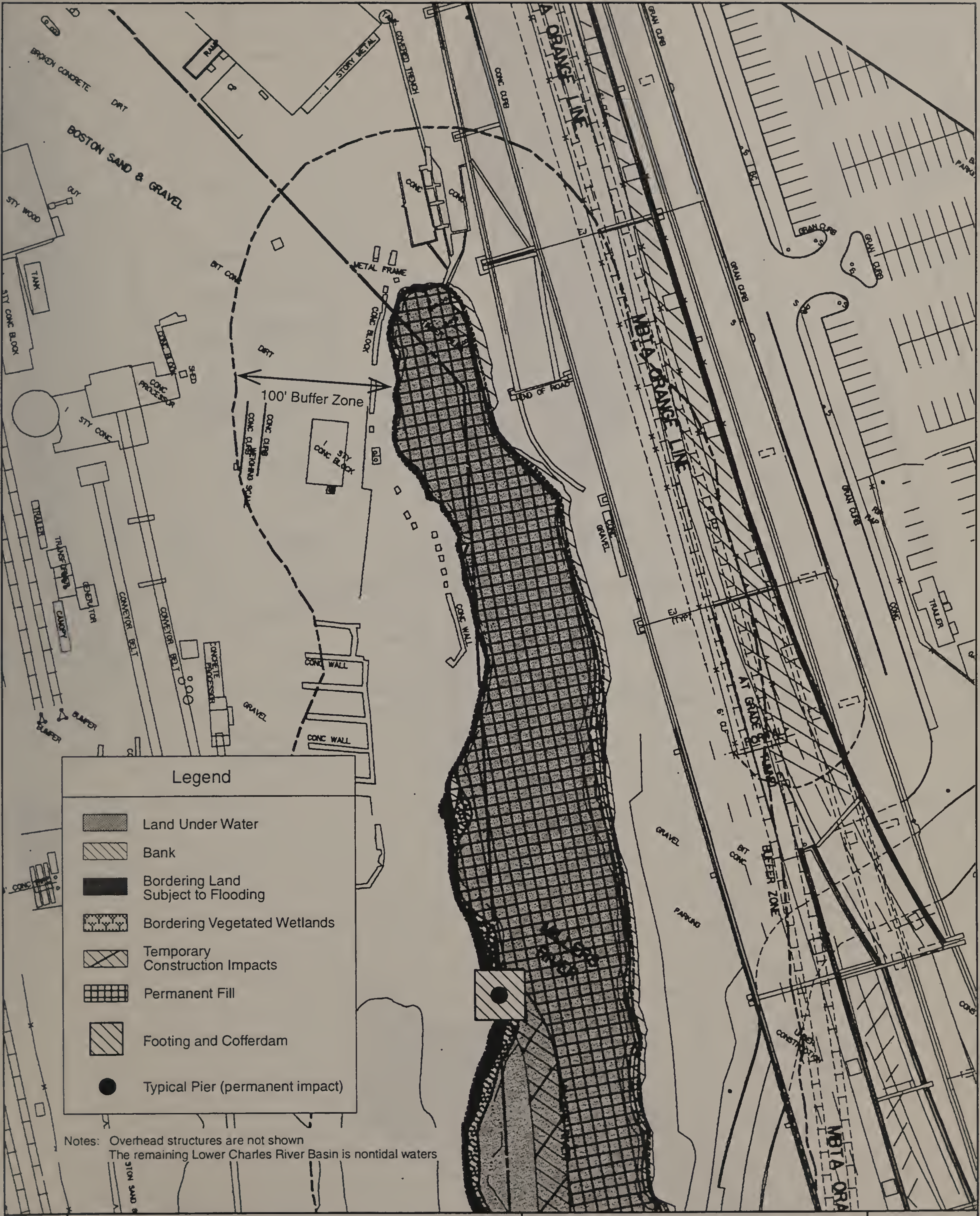
Summary Of State Wetlands Impacts. The Preferred Alternative and Scheme Z affect State wetlands. In the Millers River the Preferred Alternative affects 1,180 lf of bank, 1,300 sf of BVW, and 1.10 acres of LUW. Scheme Z affects 60 lf of bank, 350 sf of BVW, and 0.01 acre of LUW. In the Charles River the Preferred Alternative affects 75 lf of bank and 0.10 acre of LUW, while Scheme Z affects 10 lf of bank and 0.10 acre of LUW. There are no BVW in the Charles River.

Proposed Wetlands Mitigation. The proposed mitigation for impacts to State and Federal Aquatic resource areas include the creation of 9,500 sf of vegetated wetland, of which at least 1,300 sf are BVW which are hydraulically connected to the Charles River. In addition, a water feature will be constructed in the vicinity of North Point in Cambridge and Boston, and will be designed to provide 1.2 acres of open watersheet (nontidal water and LUW), 43,000 cf of theoretical flood storage capacity, and a minimum of 1,255 lf of vegetated bank (see Chapter 6, Mitigation). Mitigation for waterways interest of navigation include the removal of an old railroad trestle on the northwest side of the bascule bridge in the Charles River. This will create an additional 0.25 acre of open watersheet[6] and over 9,200 cf of theoretical flood storage. All of these mitigation measures offset the impact of bridge piers and fill in these resource areas.

4.5.3 Waterways

This section describes the impacts of the Preferred Alternative and Scheme Z on waterways in the study area. A summary of permanent impacts to filled and flowed tidelands and for filled tidelands impacts for which mitigation is required is shown in Table 4.29.

State Waterways. State waterways resources are defined by the Massachusetts Waterways Act and Implementing Regulations (MGL c. 91 and 310 CMR 9.00), and are characterized as either flowed or filled tidelands. Flowed tidelands include all submerged lands lying below the ordinary high water mark of the Charles and Millers Rivers (el. 103.3), and below the Charles River Dam in tidal waters the jurisdiction extends below the mean high water (el. 104.5). Filled tidelands include areas below the historic or natural shoreline except for "landlocked" tidelands. Landlocked tidelands are filled tidelands separated from the water by a public way, provided that the tidelands are at least 250 feet away from the water and are not located within a Designated Port Area. The State waterways interests include fishing, fowling, navigation, the protection of water-dependent uses, and overall public benefit. Navigation requirements of Federal and State regulations are discussed in Section 4.5.3. The


BROKEN CONCRETE
DIRT
BOSTON SAND & GRAVEL
1 STORY METAL
COVERED TRENCH
MBTA ORANGE LINE
GRAN CURB
CONC CURB
STY WOOD
TANK
STY CONC BLOCK
BIT CONC
METAL FRAME
CONC BLOCK
CONC PROCESSOR
SHED
STY CONC
100' Buffer Zone
CONC CURB
RETAINING WALL
1 STY CONC BLOCK
END OF ROAD
EJ
CONC GRAVEL
TRAILER
TRANSFORMERS
GENERATOR
CANOPY
CONVEYOR BELT
CONCRETE PROCESSOR
CONC WALL
GRAVEL
BUMPER
AT GRADE PORTAL
BUFFER ZONE
PARKING
MILLERS RIVER
Legend
Land Under Water
Bank
Bordering Land Subject to Flooding
Bordering Vegetated Wetlands
Temporary Construction Impacts
Permanent Fill
Footing and Cofferdam
Typical Pier (permanent impact)

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE

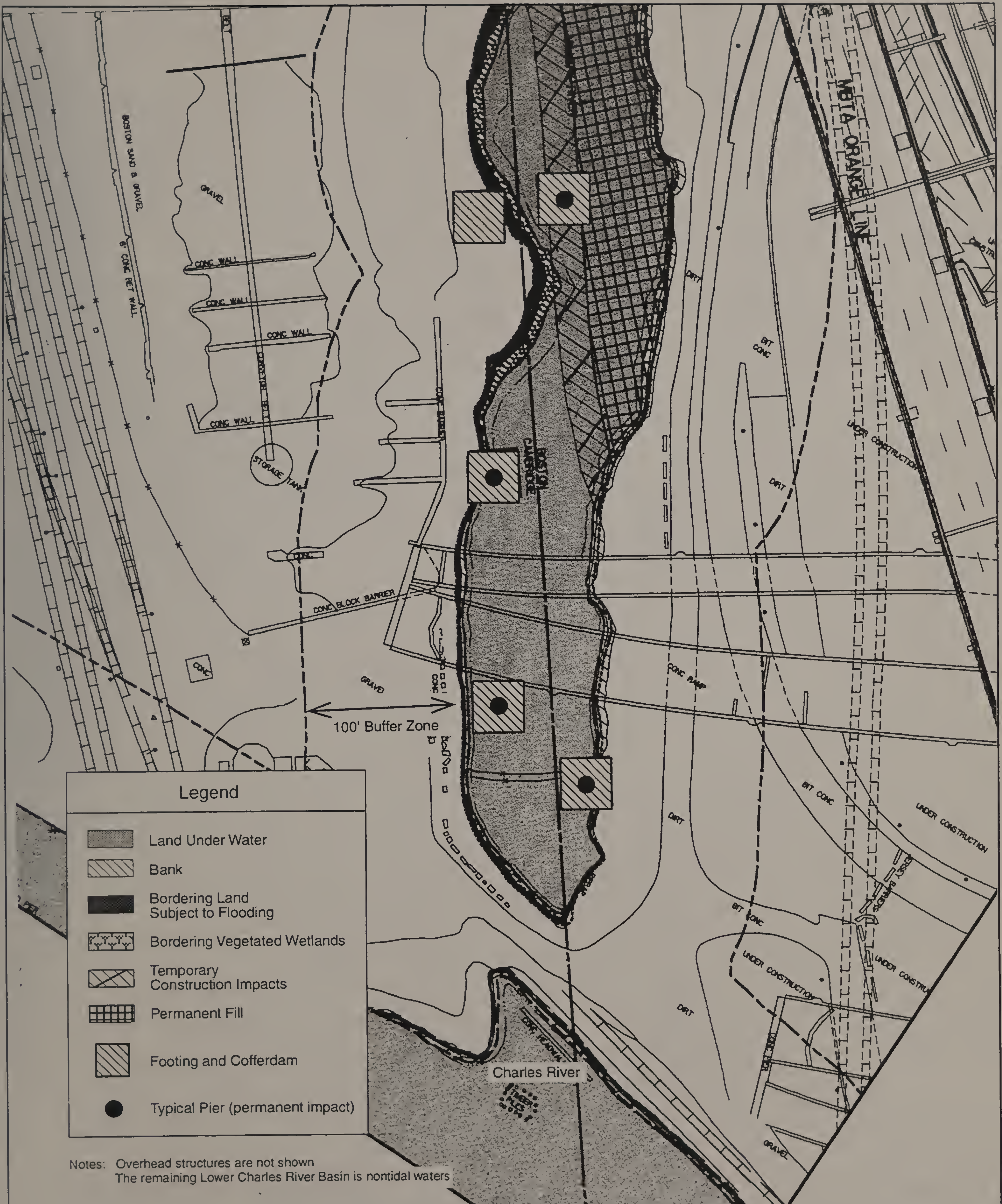
4.32

Affected State Wetlands Resource Areas; Millers River: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 80 160 FEET


Legend
Land Under Water
Bank
Bordering Land Subject to Flooding
Bordering Vegetated Wetlands
Temporary Construction Impacts
Permanent Fill
Footing and Cofferdam
Typical Pier (permanent impact)
100' Buffer Zone
Charles River
BOSTON
CAMBRIDGE
MBTA ORANGE LINE
BOSTON SAND & GRAVEL
8' CONC RET WALL
GRAVEL
CONC WALL
CONC WALL
CONC WALL
CONC WALL
STORAGE TANK
CONC
CONC BLOCK BARRIER
CONC
GRAVEL
DIRT
BIT CONC
UNDER CONSTRUCTION
DIRT
CONC RAMP
BIT CONC
UNDER CONSTRUCTION
DIRT
BIT CONC
UNDER CONSTRUCTION
UNDER CONSTRUCTION
DIRT
CONC HEADWALL
TIMBER PILES
GRAVEL
0
80
160 FEET

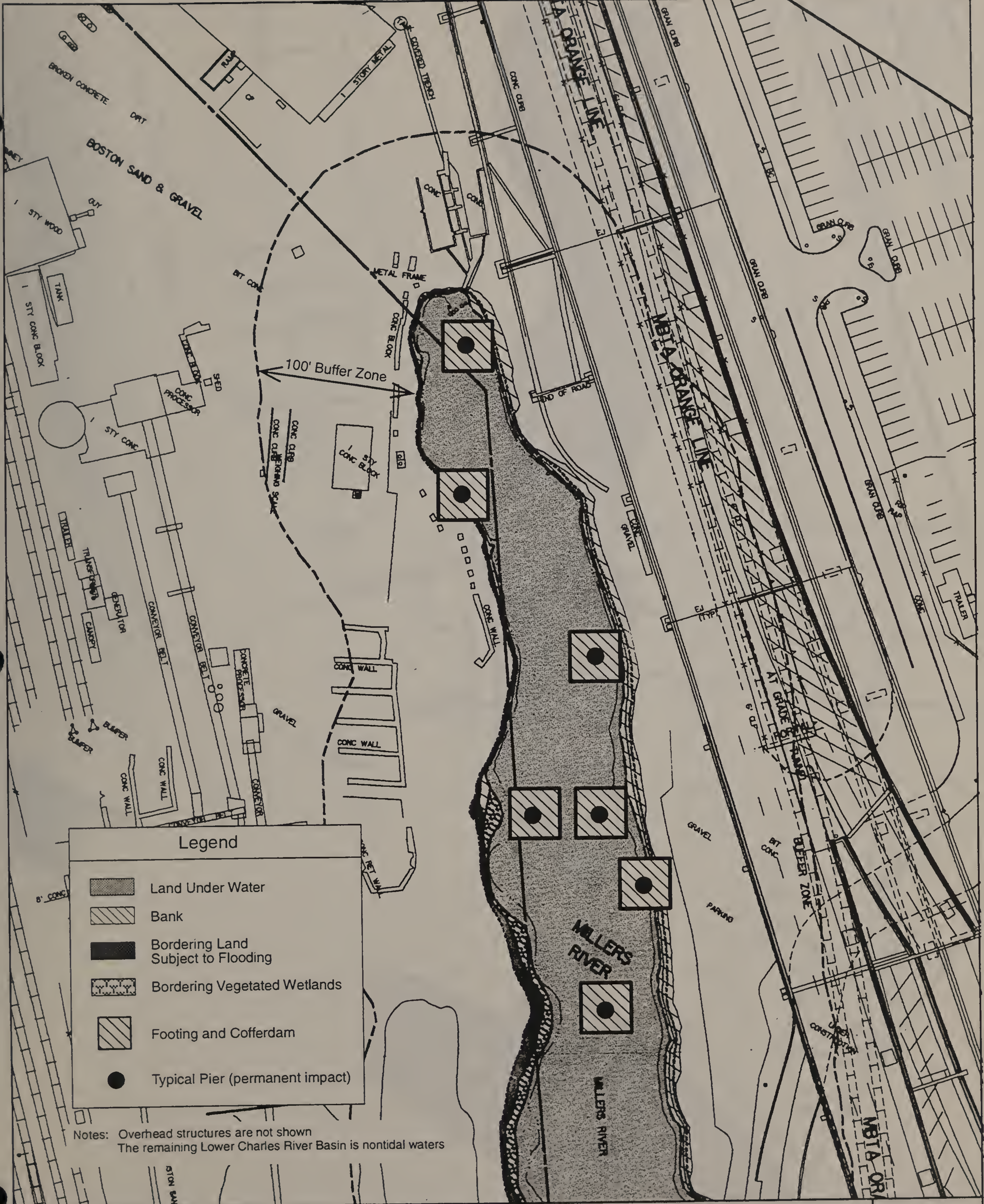
Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE 4.33

Affected State Wetlands Resource Areas; Millers River: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Legend
▨ Land Under Water
▨ Bank
■ Bordering Land Subject to Flooding
▨ Bordering Vegetated Wetlands
▨ Footing and Cofferdam
● Typical Pier (permanent impact)
100' Buffer Zone
MBTA ORANGE LINE
MILLERS RIVER
BOSTON SAND & GRAVEL
BROKEN CONCRETE
DIRT
1 STORY METAL
COVERED TRENCH
CONC CURB
GRAN CURB
METAL FRAME
CONC BLOCK
1 STY CONC BLOCK
CONC PROCESSOR
STY CONC
1 STY WOOD
TANK
SHED
CONC WALL
CONVEYOR BELT
CONCRETE PROCESSOR
CONVEYOR
TRAILER
TRANSFORMER
GENERATOR
CANOPY
BUMPER
GRAVEL
END OF ROAD
AT GRADE ROAD
BIT CONC
BUFFER ZONE
PARKING
UNDER CONSTRUCTION
0 80 160 FEET

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

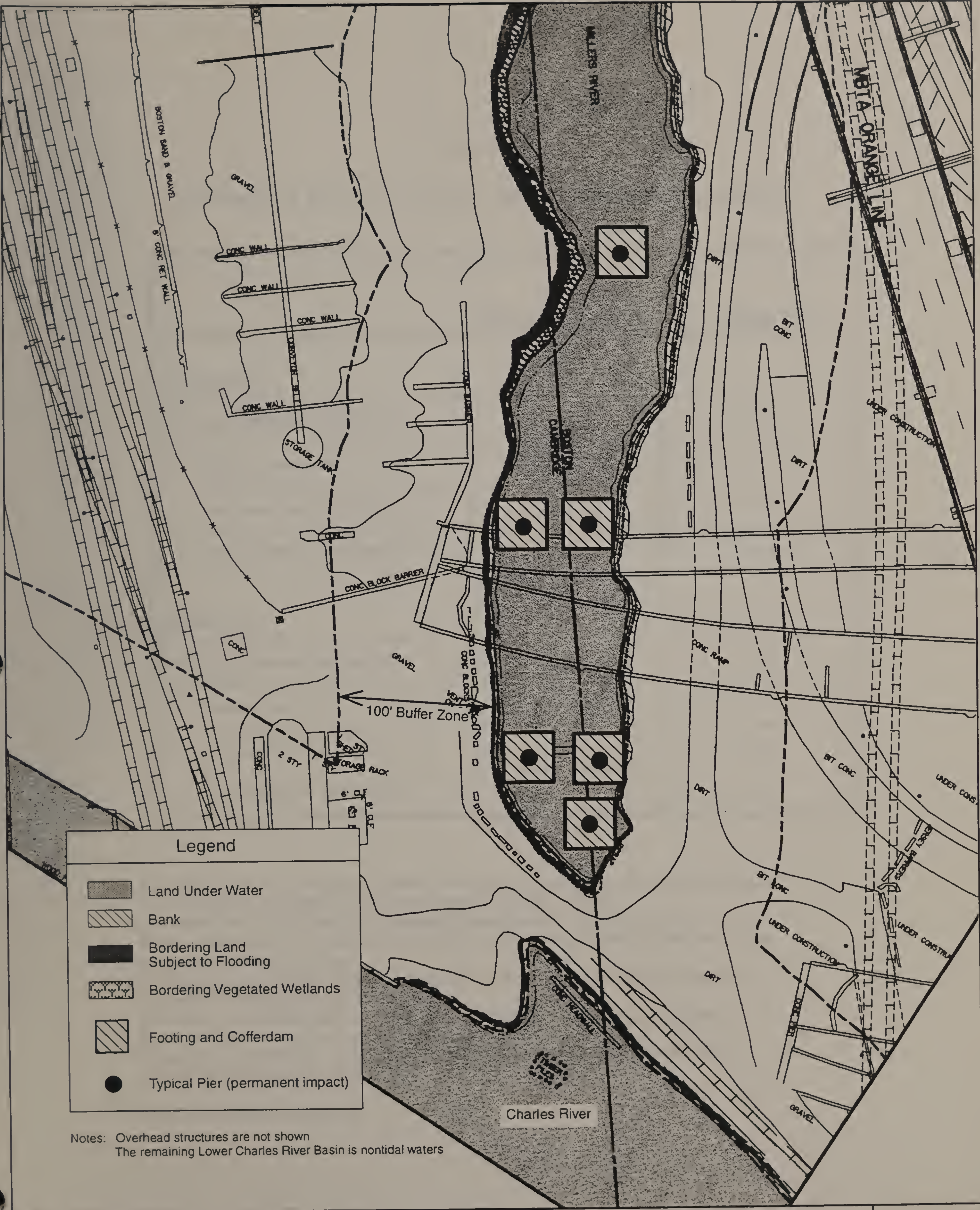
FIGURE

4.34

Affected State Wetlands Resource Areas: Millers River: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


MILLERS RIVER
MBTA ORANGE LINE
BOSTON SAND & GRAVEL
8' CONC RET WALL
GRAVEL
CONC WALL
CONC WALL
CONC WALL
CONC WALL
STORAGE TANK
CONC
CONC BLOCK BARRIER
CONC
GRAVEL
BOSTON
CAMBRIDGE
DIRT
BIT CONC
UNDER CONSTRUCTION
DIRT
CONC RAMP
CONC BLOCKS
100' Buffer Zone
CONC
2 STY
STORAGE RACK
6' CLF
6' CLF
BIT CONC
UNDER CONS
DIRT
BIT CONC
UNDER CONSTRUCTION
UNDER CONSTRU
DIRT
CONC HEADWALL
TIMBER PILES
Charles River
GRAVEL
Legend
Land Under Water
Bank
Bordering Land Subject to Flooding
Bordering Vegetated Wetlands
Footing and Cofferdam
Typical Pier (permanent impact)

Notes: Overhead structures are not shown
The remaining Lower Charles River Basin is nontidal waters

FIGURE

4.35

Affected State Wetlands Resource Areas; Millers River: Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 80 160 FEET

Table 4.28

PERMANENT IMPACTS TO STATE WETLAND RESOURCE AREAS

	Preferred Alternative	Scheme Z[1]
Charles River		
Bordering vegetated wetland (sf)	n/a	n/a
Banks (linear feet)	75	10
Land under water (acres)[2]	0.10	0.10
Land subject to flooding (cf)[3]	3,480	3,490
Millers River		
Bordering vegetated wetland (sf)[4]	1,300	350
Banks (linear feet)	1,180	60
Land under water (acres)	1.10	0.01
Land subject to flooding (cf)[5]	39,950	350

1. The impacts have been recalculated to reflect current pier dimensions and construction methods for the Millers River, thus differing from those included in the 1991 FSEIS/R.
2. The removal of 2,500 sf (0.06 acre) of existing I-93 piers and 300 sf (0.007 acre) of the existing dilapidated railroad trestle on the northwest side of the bascule bridge would reduce these quantities by 2,800 sf (0.07 acre).
3. Presumptions of significance for this resource area do not apply. These quantities represent a "theoretical" flood storage volume only.
4. This impact to bordering vegetated wetland includes temporary impacts due to construction activities. These are considered a permanent loss of resource area.
5. Presumption of significance for this resource area do not apply. These quantities represent a "theoretical" flood storage volume only.

Source: Bechtel/Parsons Brinckerhoff

Table 4.29
STATE WATERWAYS PERMANENT IMPACTS

Alternative	Flowed Tidelands (acres)	Filled Tidelands (lf)[1]
Preferred Alternative		
Charles River	0.10	585
Millers River	1.1	2,200
Scheme Z		
Charles River	0.10[2]	1,110
Millers River	0	2,200

1. The impacts for filled tidelands are those which require mitigation. For the Charles River, a 40-foot-wide corridor was established and the total linear footage of overhead structure within this corridor was assumed to affect public access. Along the Millers River, it was assumed that the entire 2,200 lf along the shoreline would be directly or indirectly affected by overhead structures and piers.

2. The removal of 2,500 sf (0.06 acre) of existing I-93 piers and 9,000 sf (0.21 acre) of the existing dilapitated wharf on the northwest side of the bascule bridge would reduce these quantities.

Source: Bechtel/Parsons Brinckerhoff

following subsections address State waterways interest, and may be applied to Federal waterways public interest.

Affected Environment. The State's Chapter 91 jurisdiction within the study area is the same as the 1991 FSEIS/R, and includes the flowed portions of the Charles River and the Millers River and filled tidelands, as shown in Figure 4.36.

Finding Of Water Dependency. The Secretary of Environmental Affairs determined in the Certificate on the DSEIR (August 29, 1990) that the Charles River Crossing, including its ancillary facilities, is a water-dependent infrastructure crossing within the meaning of the applicable Chapter 91 regulations. The October 1993 MEPA Certificate requested that MHD reexamine the issue of water dependency. In doing so, the Secretary of Environmental Affairs stated: "any structure or part of the project that was part of Scheme Z, including structures that are "ancillary" to the actual crossing facility in the same or a similar manner as they were in Scheme Z are water dependent".[7] The Certificate further states that nonwater-dependent uses which share a function with a water-dependent use are to be determined water dependent.[8]

The Area North of Causeway Street connects I-93 north and south of the Charles River, Route 1/Storrow Drive and Route 1/Tobin Bridge, Route 28 (O'Brien Highway), Routes I-93 and Route 1 (also north and south of the river), and all necessary local connections to those facilities. The elements of the Charles River Crossing have been placed in their various locations for transportation planning, engineering, design, and environmental reasons, and cannot reasonably be located outside of tidelands. Also, ramp alignments must satisfy specific design criteria which stipulate curve radii, tangent length, weave distance, minimum sight lines, and other geometric requirements which significantly limit the ability to realign or relocate ramps and approaches outside tidelands in this vicinity.

Both the Preferred Alternative and Scheme Z constitute infrastructure crossings of the Charles and the Mystic Rivers, and contain ancillary facilities necessary to achieve required traffic movements and design criteria. Hence, the Charles River Crossing designs and their land-based tunnels, ramps, surface roads, utilities, and ventilation building(s) are water-dependent public infrastructure crossings (see Appendix D, Section 2.6 for a detailed analysis of water dependency).

Existing Waterways Functions. Waterways resources within the Project areas were evaluated to establish their current functional value. The interests of navigation, public access waterside (flowed tidelands) and landside (filled tidelands), public/social benefit, and the water-dependent uses were evaluated.

Charles River. Presently, the Charles River functions well for the waterways interest of navigation. For navigation interests, the lower Charles River does not have a defined channel. The upstream limit of the USACE Federal navigation project for the Charles River is the North Washington Street bridge which is downstream of the Project limits. Historic State Harbor lines exist in the area, but have little relation to current navigation, because of filling and bridge and dam construction which has taken place over the years. Legislation addressing project compliance with existing Harbor lines will be pursued once Project design is begins.

The area presently has no public waterside access, and limited landside access via sidewalks along the waterfront. Current land uses at the water's edge are primarily rail transportation, industrial, institutional (hospital and jail), and open space. There are five active water-dependent uses: the MDC Gridley Dam and Locks, Spaulding Rehabilitation Hospital pier, the MDC Harbor Police, the existing railroad bridge, and I-93 bridges. In addition, there are approximately 2,500 lf of existing sidewalks or walkways along the river which are open to the public. There are also structures which cross the river and provide approximately 1,240 lf of walkways that are open to the public.

The Paul Revere Landing Park is located on the north and south sides of the Charles River at either end of the Charles River Dam. Paul Revere Landing Park South is presently comprised primarily of parking lots. In addition, the existing I-93 and Storrow Drive viaduct structures are directly overhead of the park, occupying approximately 0.88 acre. Paul Revere Landing Park North consists of 3.3 acres and will be improved upon completion of the landscaping required in the 1993 CANA temporary loop ramp Chapter 91 license. These improvements will create a walkway connection from Rutherford Avenue and City Square to the Charles River via this park and will provide an enhanced park and public access along the Charles River.

Millers River. While the Millers River may technically be defined as "navigable" under the waterways regulations, it is only 1,100 feet long, 80 feet wide, and 3 feet deep, and has virtually no flow. Further, the river is highly contaminated and is not connected to any other water body by a direct navigable channel. Hence its "function" in terms of navigation is, for all practical purposes, nonexistent.

The Millers River presently has a low functional value for all waterways interests. All functions are rated low as the river is functionally non-navigable (see Section 4.5.4), has no waterside public access, has limited landside public access, provides minimal public benefit, and contains no water-dependent uses (see Appendix D). Of the approximately 2,200 lf of waterfront on the Millers River, there is no improved public access.

Impacts And Conformance With Performance Standards. Because the Charles River Crossing is a water-dependent infrastructure crossing, it is presumed to serve a proper public purpose which provides greater benefit than detriment to the rights of the public in tidelands. In addition, the Special Procedures adopted by DEP on May 16, 1991, for licensing the Project state that, "...the CA/T project has been determined to merit special consideration for expedited review because there is a significant public benefit associated with the project."

The Project meets the performance standards outlined in CMR 9.31 through 9.40, as discussed below.

Impacts. Project activities are proposed in flowed and filled tidelands, and include bridges, piers, viaducts, boat sections, surface roads, land tunnels, ventilation buildings, new utilities, and utilities relocations (see Appendix D for details). Some of the activities are common to both alternatives and some are unique to a specific alternative. Activities in flowed tidelands result in limited permanent effects to navigation (see Section 4.5.4). The Preferred Alternative requires the construction of a ventilation building on filled tidelands. The visual effects of this ventilation building are described in Section 4.2.5. Finally, the Preferred Alternative places approximately 1.1 acres of fill in the Millers River for piers and an at-grade signalized intersection. This fill allows ramps and viaducts to be set back 120 feet from the banks of the Charles River.

Water-Dependent Uses. The Preferred Alternative and Scheme Z result in no permanent adverse impacts to water-dependent uses. The proposed bridge superstructure may have minor effects on the view corridor of the operators of the MDC Gridley Dam and Locks, but this will occur only in locations which are presently outside of the navigation channel. An abutment of the mainline bridge touches down on the south bank of the Charles River, varying from approximately 35 to 240 feet east to west from the bank. This will result in the direct loss of approximately 1.0 acre of the existing parking lot located at Paul Revere Landing Park South property. Overhead structures will also be placed above the park; however, existing overhead structures will be removed, resulting in no new net overhead impact.

Visual Effects. The Preferred Alternative substantially reduces the number of piers in the Charles and Millers Rivers from those described in the 1991 FSEIS/R. The fewer piers, coupled with the removal of the existing I-93 piers and a more aesthetically pleasing bridge design, improve pedestrian shoreline views to and along the existing and future waterfront walkways and parklands. The dam operators' views to the bascule bridge and to the entire width and breadth of the navigation channel are improved by removing the existing I-93 bridge piers. The pier and pile removal also increases the area and volume of the flowed portion of the Charles River. Finally, Scheme Z has two outer loop ramps which are placed very close to and over the Charles River near the southern portion of the Millers River. These ramps are relocated under the Preferred Alternative and are placed either underground on the south side of the Charles River or in an at-grade intersection in the Millers River. A substantial reduction in overhead as well as surface structures results from implementation of the Preferred Alternative as compared to Scheme Z.

Public Access. The proposed boat section on Storrow Drive minimally affects the visual quality of Storrow Drive, an MDC parkway, but no more than the existing westbound boat section. Temporary impacts to filled tidelands affect existing substandard public access. However, both the Preferred Alternative and Scheme Z substantially increase and permanently improve public access in the area. The Preferred Alternative removes the outer loop ramps proposed under Scheme Z which connect to the existing CANA ramp stubs along the north bank of the Charles River. Removal of these structures will thereby further improve public access and open space opportunities along the river. Overhead structures indi-

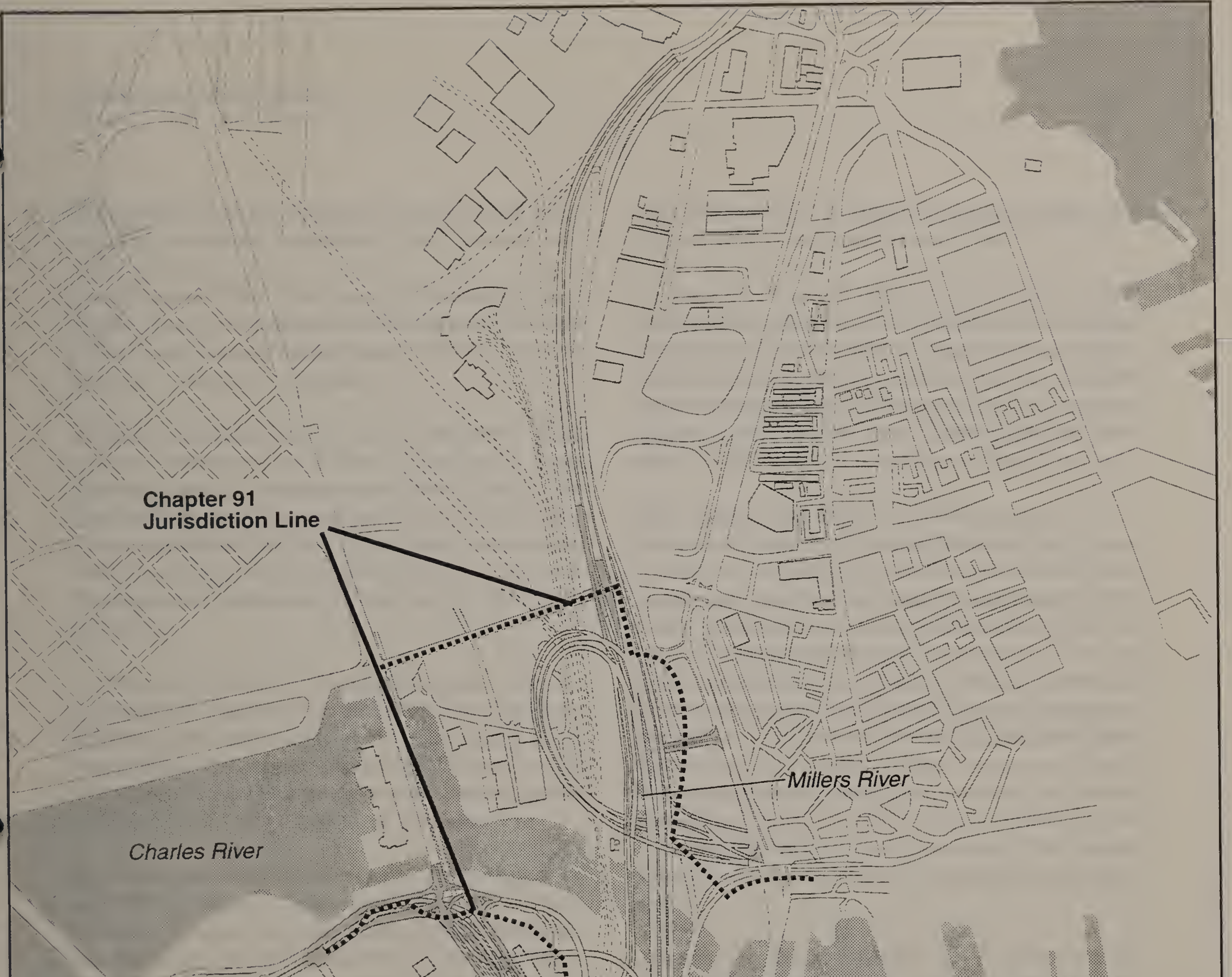

Chapter 91
Jurisdiction Line
Millers River
Charles River
0
600
1400 FEET

FIGURE 4.36

State Waterways Jurisdiction: Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

rectly affect public access along the entire Millers River and along the north and south banks of the Charles River.

Conformance With Waterways Performance Standards. The major components of the Project are reviewed below to demonstrate conformance with the applicable Chapter 91 performance standards.

Categorical Restrictions On Fill And Structures: In the Preferred Alternative and Scheme Z, the Charles River Crossing requires the placement of bridge piers in the Charles River and bridge and ramp piers in the Millers Rivers (see Table 4.28). As pier-supported structures for water-dependent uses, the proposed bridges comply with the categorical restrictions outlined in 310 CMR 9.32 (1)(a)(2).

The Preferred Alternative results in the placement of approximately 1.1 acre of fill in the Millers River for an at-grade intersection (see Table 4.28). The amount of fill is minimized, its placement cannot reasonably be located upland, and it is a water-dependent use thus complying with 310 CMR 9.32 (1)(a)(2) (see Appendix D).

Environmental Protection Standard: The Preferred Alternative and Scheme Z comply with the approved Massachusetts Coastal Zone Management (MCZM) Program, and the design will be implemented in a manner consistent with that program. A statement regarding the consistency of the Project is included in Appendix E of this FSEIS/R. Prior to the issuance of an individual license for the activities described herein, MHD will comply with the provisions of the Massachusetts Environmental Policy Act; obtain required approvals under the Wetlands Protection Act; and obtain a Water Quality Certification for activities as required in this area.

Conformance With Municipal Zoning And Harbor Plans: The Cambridge Zoning Laws and the Boston Zoning Code are not applicable to the Project, a State highway project. The City of Cambridge does not have an approved Municipal Harbor Plan. The Secretary of Environmental Affairs approved the City of Boston Municipal Harbor Plan on May 22, 1991. The plan covers Boston Harbor proper; thus, the Project alignment is outside the plan boundaries. In the approval, the Secretary found that the Municipal Harbor Plan does not apply "to any State project or portion thereof that is exempt from zoning requirements by law." The Project, as a State highway project, is exempt from compliance with local zoning by-laws and, therefore, the approved Municipal Harbor Plan does not apply to this project.

Standards To Preserve Water-Related Public Rights: While Project activities occur in both filled and flowed tidelands, neither the Preferred Alternative nor Scheme Z significantly impairs the rights held by the Commonwealth in trust for the public to use tidelands for public purposes, which include water-related rights and interests in fishing, fowling, navigation, and public access.

Public Rights Applicable To All Waterways.
Navigation: Under the Preferred Alternative and Scheme Z, there will be temporary impacts on navigation due to construction activities, but the permanent impacts of the Project on navigation are expected to be minimal. No piers will be placed in the navigation channel. The proposed bridges will have a minimum vertical clearance of 23 feet above recreation locks and 30 feet above the commercial lock, which maintains existing minimum clearances in the river. Indirect shading impacts are expected to be minor factors in navigation, as vessels in this area generally are moving at a slow speed or queuing to wait for the bascule bridge or the locks to open. Both designs place permanent piers in the river, outside the navigation channel.

These impacts will be offset through the removal of existing I-93 bridge piers and 9,000 sf of deck from the old railroad trestle on the northwest side of the bascule bridge after consultation with the owner(s). The Preferred Alternative results in a net removal of fill from the flowed portion of the Charles River. Hence, no significant interference with public rights of navigation will occur. Bridge and ramp piers as well as fill will be placed in the Millers River. While resulting in the loss of open watersheet, the Millers River is functionally non-navigable; therefore, these activities will not adversely affect the navigational interests in these areas (see Section 4.5.4, Navigation, and Appendix D).

Free Passage Over And Through Water: Neither the Preferred Alternative nor Scheme Z precludes free passage over and through the Charles River. Passage over and through the Millers River is presently precluded as the river is functionally non-navigable.

Access To Town Landings: There are no known town landings within the Project area and, thus, this standard does not apply.

Public Rights Applicable To Tidelands.
Fishing And Fowling: Neither the Preferred Alternative nor Scheme Z significantly interferes with the public rights of fishing and fowling, and both improve public access. The performance standards are met as the Project does not pose any substantial obstacle to the public's ability to fish or fowl in the waterway areas adjacent to the Project site; and the Project does not result in the elimination of traditional fishing or fowling locations used extensively by the public.

On-Foot Passage: Neither design significantly interferes with the public rights to walk or otherwise pass freely on private tidelands or Commonwealth tidelands. The Project is a water-dependent use on filled Commonwealth tidelands and, thus, the standards require the provision of public passage by such means as are consistent with the need to avoid undue interference with the water-dependent uses in question. Public access along the banks of the Charles River, which is currently restricted by the presence of highways, railroad tracks, and other institutional uses, will be increased and improved.

Disruption to existing pedestrian use within the entire area of Chapter 91 jurisdiction is minimal because current pedestrian use is low to nonexistent in all areas, except for pedestrians crossing the river via the walkway along the Charles River Dam and locks at Paul Revere Landing Park North and South. Consequently, the net effect of the Preferred Alternative and Scheme Z is one of opening up the area to pedestrian use. Section 4.2.2, which describes the open space and parklands impacts, and the Section 4(f) Evaluation demonstrate that the proposed improvements far outweigh any adverse impacts.

Both designs result in a substantial increase in area devoted to water-dependent uses and provide reasonable measures for on-foot passage along and to portions of the north and south banks of the Charles River. Access is proposed along the southern portion of the Millers River as part of the overall mitigation plan (see Chapter 6, Summary of Mitigation Measures).

Compensation For Interference With Public Rights In Commonwealth Tidelands: The alternatives do not propose any private use of Commonwealth tidelands and, thus, this standard does not apply.

Management Of Areas Accessible To The Public: The long-term management of public facilities, including walkways and open space located on tideland areas, will be identified during the licensing process for this area.

Standards To Protect Water-Dependent Uses: The only active water-dependent uses on the Charles River within the Project area are the MDC Gridley Dam and Locks, the Spaulding Rehabilitation Hospital pier, the MDC Harbor Patrol, the existing railroad and I-93 bridges, Paul Revere Landing Park North and South, and the various walkways. The Project design preserves the availability and suitability of these waterways as they are presently used by the existing water-dependent uses. The Charles River Crossing designs have minimal impacts on navigation and will not impede the right of access by water to adjacent property owners' land.

The Preferred Alternative and Scheme Z result in increasing the number of water-dependent uses and improving benefits to the public in and along the Charles and Millers Rivers. Another beneficial impact of the alternatives is that both aid implementation of portions of the MDC parkland master plan proposals for the Lower Charles River Basin. Without the Project, the achievement of open space improvements and functional pedestrian linkages would occur haphazardly, being constrained by public funding and by conflicting private interests.

Private Access To Littoral Or Riparian Property: None of the bridge piers proposed in the Charles River affects private access to riparian property. In the Millers River, access from the water is not presently available and private access to the water is not precluded. Neither design interferes with littoral or riparian property owners' rights to approach their property from the Charles River or to approach the Charles River from their property.

Disruption Of Water-Dependent Use: The two designs may have a minor effect on the MDC Gridley Dam and Locks operators' view corridor. This will be evaluated in more detail in subsequent bridge design development.

Displacement Of Water-Dependent Use: There are no existing water-dependent uses in the Project area that will be displaced by the Project, except the existing I-93 bridge which will be removed and replaced by a new bridge. The mainline bridge touches down on the south bank of the Charles River approximately 150 feet from the shoreline. This will displace a portion of the existing parking lot at Paul Revere Landing Park South. This parking lot is not a water-dependent use. Overhead structures will also be placed above the park; however, existing overhead structures will be removed resulting in no new net overhead impact.

Fill Or Structures Which Preempt Water-Dependent Industrial Use Within A Designated Port Area: The Project area is not in a Designated Port Area; thus, this standard does not apply.

Engineering And Construction Standards. The Project is being designed and will be constructed in accordance with accepted engineering and construction standards.

Use Standards For Recreational Boating Facilities. No recreational boating facilities are affected or being proposed; therefore, this standard does not apply.

Standards For Marinas, Boatyards, And Boat Ramps. No marinas, boatyards, or boat ramps are being proposed; thus this standard does not apply.

Limited water excavation (dredging) is necessary under both designs for the placement of bridge piers. These impacts are temporary (see Section 5.2) and will meet the waterways standards.

Summary Of State Waterways Impacts. Both the Preferred Alternative and Scheme Z alter or remove some existing waterways resources, including filled and flowed tidelands. However, mitigation for impacts will be provided and, compared to existing conditions, will improve the waterways functions within the Project alignment in the Area North of Causeway Street. The Charles River Crossing, in conjunction with other aspects of the overall Project, will also substantially improve highway access to the maritime industrial Port of Boston.

The analysis of impacts and conformance with performance standards demonstrates that the Charles River Crossing has no adverse long-term effect on the interests of fishing and fowling and, thus, no mitigation for these interests is required. Finally, under both designs, on-foot passage within the Project area is greatly enhanced over existing conditions, and public access improvements will be made. For the reasons described in Appendix D, all Project activities within Chapter 91 jurisdiction, regardless of design, are water dependent. Under the Preferred Alternative, major traffic movements are relocated from outer loop ramps and viaduct structures and placed in underground structures which will have minimal impact on the public interest in filled tidelands.

The two types of State waterways resource areas that are permanently affected by the Preferred Alternative and Scheme Z are flowed tidelands (i.e., the Charles and Millers Rivers) and filled tidelands (i.e., formerly flowed tidelands). The Preferred Alternative results in fewer impacts than Scheme Z on both banks of the Charles River due to the inclusion of land-based tunnels between Storrow Drive and the Central Artery, which maximizes waterways interests of public access and visual quality. Some of the additional benefits of the Preferred Alternative over Scheme Z are a reduction in the amount of viaducts and piers, removal of loop ramps away from the banks of the Charles River, placement of structures underground, improving navigational interests of the Charles River, and improving the visual environment in all of the planned riverfront parkland areas. Substantial new public access (on-foot passage) is provided along and to the north and south banks of the Charles River.

Proposed Waterways Mitigation. The Chapter 91 regulations require mitigation for those permanent impacts which adversely affect the public interests in tidelands including navigation, fishing, and fowling; and require the provision of on-foot passage where feasible. The regulations under 310 CMR 9.35 (1) acknowledge the fact that water-dependent uses provide public benefits, but in some cases also result in "unavoidable interference with certain water-related public rights." The regulations state that such interference may be allowed provided that the overall public trust in waterways is best served and appropriate mitigation is provided. The following mitigation measures ensure that the overall public trust in waterways is best served by the Project.

CANA Mitigation: The CANA project has been partially completed under the CANA Chapter 91 license, issued in 1987. The balance of the project authorized in the license (85 percent) has been redesigned and will be integrated into the Central Artery/Tunnel Project. Hence, the mitigation of the waterways impacts includes the outstanding CANA mitigation elements (see Appendix D).

Flowed Tidelands: Mitigation measures for direct and indirect impacts to navigation include the provision of fender systems and maintaining the view corridor of the MDC Gridley Dam and Locks operators, if necessary.

The existing I-93 piers will be removed to the mudline, and an old railroad trestle on the northwest side and piles on the southwest side of the bascule bridge will be removed after consultation with the owner(s). Finally, a 1.2-acre water feature, navigable by small craft, will be constructed from upland in the North Point vicinity. Combined, these activities create an additional 1.4 acres of watersheet which will offset the Project impact on open watersheet in the Charles and Millers Rivers.

Filled Tidelands: In addition to implementing the CANA mitigation measures, on-foot passage will be provided along the north and south sides of the Charles River which is at least equivalent to the net total linear footage of shoreline occupied by overhead structures within a 40-foot corridor.

Pedestrian access along Lovejoy Wharf on the south side of the river will be provided, and 4.3 acres of land will be added to Paul Revere Landing Park North as a result of the removal of the existing I-93. To offset the indirect effect of the proposed Storrow Drive boat section on the Esplanade parkland, a pedestrian walkway between the Historic Dam North and Historic Dam South areas and a pedestrian overpass between Leverett Circle and the Nashua Street parcel will be constructed. Finally, while not identified as mitigation for waterways impacts, substantial public access, and landscaping improvements to the lower basin are proposed as described in the Final Section 4(f) Evaluation and in Chapter 6, Summary of Mitigation Measures. Implementation of the waterways and 4(f) mitigation measures will create a continuous public access system at least 10 feet in width along the shoreline of the Lower Charles River Basin.

Performance standards have been established for the water feature and parkland elements of the mitigation plans (see Chapter 6). It is anticipated that the Chapter 91 licenses issued on the Project will include conditions which require construction of the mitigation plan.

4.5.4 Navigation

No permanent impacts hazardous to navigation in the Charles River are expected from the Preferred Alternative. As design of the Preferred Alternative proceeds, it will address the proximity of bridge piers to the Charles River navigation area. The evolving design will be reviewed with the MDC Marine Police, the U.S. Coast Guard (USCG), USACE, and other agencies concerned with marine safety and navigation.

4.5.4(a) Overview Of Permanent Navigational Impacts

There are two bridges proposed to cross the Charles River under the Preferred Alternative. These bridges have been evaluated for impact on navigation both from the standpoint of obstructions in the waterway as well as reduced visibility, wind, and shadow. The cable-stayed bridge requires one 30-foot in diameter pylon on the south side of the river in the waterway and a portion of a 60 by 60-foot pylon footing partially in the waterway on the north side. The second bridge requires two 10 by 46-foot footings, each on the south bank and in the Charles River at its northern limit. All proposed piers required for the Preferred Alternative will be located behind the current fender pier lines, and therefore out of the area used for navigation. The Preferred Alternative represents a reduction from Scheme Z in the number of piers scheduled for placement in the Charles River.

The Preferred Alternative reduces the number of structures in the waterway and the number of lanes above the waterway from the Scheme Z plan. Accordingly, the long-term impacts of the Preferred Alternative are beneficial to navigation interests.

4.5.4(b) Other Permanent Impacts

The effects from wind, shadows, and visual obstructions are discussed below.

Shadows. A shadow study of the Preferred Alternative and Scheme Z shows that there is no deleterious impact to navigation resulting from shadow effects of the proposed bridge structure under either design. Any bridge structure will cast the widest shadows over the river yearly on December 22 at 3:00 PM. There are few boaters using the river in December so this impact will be negligible. At that time, the maximum expanse of shade experienced by waterborne traffic will be 300 linear feet of shade for the Preferred Alternative and 340 linear feet of shade for Scheme Z. in both instances, the shade is not continuous because of the separation between the bridges, two bridges with the Preferred Alternative and three bridges with Scheme Z.

Visual. The visual obstructions cited in the 1991 FSEIS/R for Scheme Z are diminished because of the reduction in the number of piers for the Preferred Alternative.

Wind. Navigation in the Charles River is not adversely affected by wind effects of the Preferred Alternative. In comparing the Preferred Alternative with Scheme Z, for potential effects of wind on navigation, the width and thickness of the bridge deck, the height above water of the bridge span, and the number, size, and spacing of the bridge piers were considered. Since Scheme Z includes a double-deck bridge and a relatively wide deck for the two mainline bridges, as well as more piers than the Preferred Alternative, Scheme Z has more impact on wind and flow disturbance. However, significant flow acceleration under either design is not expected, and wind flow disturbance resulting from bridge piers is localized so that no boating activity will be affected.

Summary. The subsequent design process for the Preferred Alternative will clarify the long-term impacts, if any, to navigation. The design will be reviewed with the relevant regulatory agencies including the MDC, USACE, and USCG to identify measures to mitigate any long-term impacts. There is a slight positive benefit to permanent navigational impacts with the Preferred Alternative over Scheme Z.

4.5.4(c) Mitigation Measures

Long-term commitments/mitigation for navigation:

- Navigation and lighting aids will be located in coordination with the MDC and the USCG.

- Retaining walls, fender piers, and dolphins on both sides of the new dam will be rehabilitated if affected by construction activity.

- A pier fendering system will be provided for all new piers.

- Existing I-93 bridge piers will be removed except for the banana pier which will be marked with navigational aids.

- Vertical clearances of 23 feet for the recreational locks and 30 feet for the commercial lock will be maintained.

- The Charles River piers will be placed to allow passage of a 300-foot barge.

- All bridge piers will be placed outside of the line of navigation, in line with existing fenders wherever possible.

- A CADD model study will be used to study the view from several locations to ensure maintenance of the view of dam operators.

- If necessary, closed-circuit TV monitors will be provided to dam operators.

- The Crossing will not impede the right of access by water to adjacent property owners' land.

4.5.5 Fisheries

4.5.5(a) Affected Environment

The Charles River has a warmwater fishery and an anadromous fish run. During 1981, the Massachusetts Division of Fish and Wildlife (MDFW) conducted a survey near the Boston University bridge that reported golden shiners, white perch, alewife, pumpkinseed, yellow perch, white sucker, white catfish, northern pike, chain pickerel, and brown bullhead. Fish also common to the basin could include bass, bluegill, crappies, carp, pickerel, and various minnows (Mugford, 1969). American eel and alewife represent fish species which migrate through the Charles River Dam. Alewife are the most common among anadromous species (which also include American shad and blueback herring) that migrate to the Charles River to spawn. Eels, conversely, are catadromous: i.e., they migrate to the sea to spawn, the young return to fresh water after their first year of growth.

Species most common to the area of the Charles River Crossing would be those that prefer low flow, deep water pools except during migratory periods when herring are the predominant species. The following sections describe the general condition of fisheries, and the major differences in the permanent impacts of proposed crossing options.

General. The value of the Charles River Basin as a deep water pool fish habitat may be somewhat limited by the high biological and chemical oxygen demands reported for the Charles River in the 1991 FSEIS/R. Reduced oxygen concentrations and soft sediments lower the value of the basin as spawning habitat. This is particularly true for the Millers River that joins the Charles

River just above the dam. The Millers River is connected to the Charles River by two 84-inch culverts that are partially filled with sediments. When the Millers River was sampled using electrofishing methods on November 28, 1989, no fish were observed. Sediments sampled for invertebrates further indicated the area was devoid of insect forage for fish. Oxygen concentrations were high enough to sustain fish life only adjacent to the culverts. The Millers River does not provide a fish resource.

Alewife migration from the Boston Harbor estuary into the Charles River is also somewhat impeded by the locks and dam. The fish ladder that was built into the dam's structure to facilitate migration, has been inoperable since 1988. The gating and pumping system, which controls the freshwater flow attracting alewife to the ladder, no longer functions. Also, because the upstream gate no longer opens, fish that enter the passage cannot gain access to the Charles. Consequently, fish that successfully migrate into the Charles River have done so by passing through the locks.

Despite these limitations, this pool of the Charles River Basin provides feeding and spawning habitat for a warmwater fishery. In the immediate vicinity of proposed construction much of the shoreline is developed, with vertical concrete and rock walls. Piers of existing bridges and the dam provide structure used for protection and feeding, while shallow areas upriver would provide additional, and better spawning habitat.

Shoreline and channel structures, such as walls and piers, serve as surfaces for algal growth which provides a food resource for many fish species (e.g., golden shiner) and the invertebrate forage (e.g., crustaceans, snails, midge larvae) for other fish (e.g., brown bullhead). Most frequent in the midwaters of the basin during the summer would be those species that feed on plankton or hatching insect larvae (e.g., bluegill, golden shiners). Others common to the deeper water would include those that feed on invertebrates found in the soft sediments, such as the white sucker. In contrast, fish such as pumpkinseed most likely inhabit vegetation in shallows upriver, and only school in the deeper waters near the dam during the winter.

The rock and gravel, and shallow, vegetated areas upriver of the dam provide the better spawning habitat for many of the species listed by the MDFW. The shallows provide attachment surfaces for species that lay adhesive eggs (e.g., pumpkinseed, brown bullhead, northern pike) and vegetation that provides larval fish with refuge from predation. Eggs broadcast by some species, such as the yellow perch, are unlikely to develop successfully if spawning occurs in deeper waters adjacent to the dam.

4.5.5(b) Permanent Impacts

There are no permanent adverse impacts to fish habitat in the Charles River under Scheme Z or the alternatives. Since the Millers River does not sustain fish habitat, there are no permanent impacts. In addition, since the new alternatives have fewer piers in the water compared to Scheme Z, the alternatives have reduced impacts (for construction period impacts, refer to Section 5.10.4).

Charles River. The piers placed in the Charles River and the shade beneath them provide structure and cover preferred by many sunfish (e.g., crappies, bluegill). Juvenile American shad have also been observed (personal communication; Boyd Kynard, U.S. Fish and Wildlife Service) to take residence in shadows during their downstream migration in the Connecticut River. Juvenile shad, which tend to move in the afternoon and evening (O'Leary and Kynard, 1986), may inhabit the shady refuge until light intensity lowers later in the day, or during cloud cover. These shad also, unlike the alewife and blueback herring of the Charles River, appear to avoid entering a distinct shadow as adults. Inasmuch as observations about shad responses to shadows have not been scientifically evaluated, similar reactions to shadows have never been reported for the species (i.e., alewife or blueback herring) that migrate into and from the Charles River in the spring and fall, respectively. Alewife and blueback herring move more consistently throughout the day, and exhibit seaward migration in response to decreases in water temperature (O'Leary and Kynard, 1986) and rainfall events (Stokesbury and Dadswell, 1989). There are several additional reasons why, regardless of the species of herring, the Preferred Alternative would not affect migratory patterns.

The Charles River has shadows cast upon it by the existing dam, I-93, and the railroad bridge on either side of the bridge crossing. The impact of shadows added to those already cast on the river pool is likely to have minor, if any, effect on migratory behavior. And unlike many structures casting shadows on the Charles (e.g., locks and dam), the Preferred Alternative has components separated to the greatest practical extent; thus allowing sunlight to illuminate the waters beneath it. Furthermore, modeling conducted to describe visual impacts (1991 FSEIS/R; Part IIB 1, Section 1.4.9) showed that, during the spring when anadromous herring are migrating to fresh water, the first shadows encountered by fish during most of the day would be formed by sunlight passing through the cables suspending the main bridge structure. The angle of incidence allows cables to serve in defracting the sunlight; thus softening the shadow edge cast upon the water which is first experienced by the fish that pass through the locks and dam. Furthermore, the shadow cast during the fall by all bridge designs provides the shade that is preferred by downstream migratory shad. The shadow created in the afternoon and evening extends to the fishway, and therefore tends to promote migration from the river basin eliminating the transitions from shadows during migration from the basin. The shadows cast by all of the alternatives would less likely affect behavior than those formed by existing structures, even assuming alewife would respond to shadows.

The Preferred Alternative minimally affects shallow shoreline habitat. While most of the impact is temporary, changes in substrate could contribute to minor, localized changes in species composition. These areas provide nesting habitat for species that guard their nests (e.g., bluegill, bass, white catfish), or attach or cast their eggs for attachment to vegetation (e.g., pumpkinseed, yellow perch). Because of the limited amount of habitat affected and the abundance of this habitat throughout the basin, a local change does not affect river fisheries.

Millers River. The Preferred Alternative results in partial filling of the Millers River. Because it currently does not sustain fish or forage, there is no permanent negative impact to fisheries of this river. Low flow, high water temperatures, and low oxygen concentrations likely preclude fish and insects from using the shallow river.

Summary. There are no significant permanent fisheries impacts for the Preferred Alternative (for construction period impacts refer to Section 5.10.4).

4.5.6 Water Quality

4.5.6(a) Lower Charles And Millers Rivers

Following construction of the new dam and locks in 1976, tidal fluctuations within the lower Charles River have been effectively eliminated. The new dam is operated to maintain constant water depth in the Charles River, and is part of the flood protection measures for the low-lying areas of the Boston region. During storm events a large pumping station located at the dam is activated to evacuate large volumes from the Charles River Basin to prevent flooding.

The Millers River functions largely as a drainage channel for its approximately 1,000-acre watershed. The Millers River hydrologic, hydraulic, and hydrographic conditions are normally controlled by backwater from the Charles River. Therefore, the water fluctuations in the river are determined by the elevation of the Charles River. The Millers River flows through two subsurface 84-inch culverts located approximately 900 feet upstream of the Charles River dam and flood control pumping station.

The lower Charles River and the Millers River have been classified by the DEP/DWPC as Class B waters. Class B waters are designated for primary and secondary contact recreation, and as a habitat for fish, aquatic life, and wildlife. The most recent water quality data available suggest that Class B water quality standards are not consistently met in either the Charles or Millers Rivers. DEP has designated the Charles River Basin above the new dam as nonsupport (NS), indicating that the standard is not met. According to DEP, the Charles River Basin's water quality problems are high fecal coliform counts and low dissolved oxygen concentrations caused by combined sewer outfalls (CSO), urban runoff, and sediments.

4.5.6(b) Permanent Impacts

The Preferred Alternative involves two bridges over the Charles and Millers Rivers, as well as partially filling the Millers River. The existing drainage culverts at the north end of the Millers River (its source) within the proposed fill area are extended southerly to discharge into the remaining Millers River, thus maintaining its detention basin function.

Scheme Z involves the following Project structures and work to take place in or adjacent to the lower Charles River and the Millers River (for construction period impacts see Section 5.10.5):

- three new bridges over the Charles and Millers Rivers
- loop ramp structures east of and above the Millers River

- demolition of the existing Central Artery bridge over the Charles River

Both stormwater and tunnel washwater discharges are regulated by EPA and DEP under the National Pollutant Discharge Elimination System (NPDES) permit program and the Massachusetts Surface Water Discharge Permit Program, respectively. Stormwater flow generated on the roadway facilities in Scheme Z does not cause a significant degradation of water quality. The Preferred Alternative generates less stormwater flow than Scheme Z since more roadway is in tunnel. In addition, this stormwater from the viaducts is discharged downstream of the new Charles River locks and dams into Boston Harbor to avoid direct discharge of salt-laden water into the freshwater reach of the Charles River. The tunnel washdown water is discharged to sanitary sewers to provide for proper treatment before discharging to receiving waters.

Summary. Thus, the Preferred Alternative has less impact on water quality than Scheme Z.

4.5.7 Other Aquatic Resources

The following sections discuss permanent impacts on other aquatic resources including water body modification, wildlife, floodplains, wild and scenic rivers, coastal barriers, and the coastal zone.

4.5.7(a) Water Body Modification And Wildlife Impacts

Permanent water body modification impacts include fill in the northern portion of the Millers River and piers in the Charles River for overhead bridge structure.

Wildlife habitat impacts are minimal since there is little wildlife use of the lower Charles River Basin area. There is almost no means of access by terrestrial wildlife to the Charles River and the adjacent Millers River, as the rivers and their narrow fringe of vegetation are entirely surrounded by industrial or railroad lands. Birds using the Charles River will experience no long-term impacts from the Project.

4.5.7(b) Floodplain Impacts

The 100-year flood level in the lower Charles River and the Millers River is 104.3 feet. Because the water elevation in the Charles and Millers Rivers is controlled by the Charles River Dam, any flood storage capacity lost between the present water surface (102.4) and 104.3 feet does not significantly change flood levels. Nevertheless, the banks of the southern part of the Millers River, as well as the banks of the Charles River in two places adjacent to the Crossing, will be excavated as mitigation measures, increasing the flood storage capacity of this part of the Charles/Millers system. Accordingly, Scheme Z and the Preferred Alternative have no adverse effects on the floodplains.

4.5.7(c) Wild And Scenic Rivers Impacts

There are no wild and scenic rivers in the vicinity of the Project.

4.5.7(d) Coastal Barriers Impacts

There are no coastal barriers in the vicinity of the Project.

4.5.7(e) Coastal Zone Impacts

The Charles River Crossing is situated in an area of nontidal fresh water, upstream of the Charles River Dam. The Project activities downstream of the existing I-93/ Route 1 bridge are in the coastal zone, which is under the jurisdiction of the Massachusetts MCZM Program. The MCZM Program was established to protect and manage the development and use of the coastal zone under the provisions of the Federal Coastal Zone Management Act of 1972. This is accomplished by the MCZM office making certain that proposed developments in the zone are consistent with 27 regulatory and nonregulatory MCZM policies. All of the Project structures and construction activities are within or near the coastal zone and therefore may affect land or water uses within the area regulated by the MCZM Program. The Charles River Crossing and its structures or activities are subject to a determination of consistency with the MCZM Program (see Appendix E).

On December 1, 1983, the MCZM issued conceptual concurrence that the proposed Project in the 1983 DEIS/ R complied with CZM Program policies. This was reaffirmed by MCZM for Scheme Z in the 1991 Projectwide FSEIS/R. The Preferred Alternative is consistent with MCZM policies.

4.5.8 Summary

A new bridge crossing of the Charles River is a component of the Preferred Alternative and Scheme Z; any such crossing requires placement of fill in limited areas of the Charles River and the Millers River for structures such as bridge piers. While overall long-term wetlands and water resources values are not significantly adversely affected by either design, the Preferred Alternative does differ in a number of respects from Scheme Z with respect to aquatic impacts.

The smaller bridge structures and reduced number of piers in the Preferred Alternative represents an improvement over Scheme Z. These bridge designs place less structure in nontidal waters and also leave greater areas of the Charles River open, unshadowed, and unobstructed for navigation. With the removal of the existing I-93 bridge and its attendant piers (except the reverse banana pier), fill in the waters of the Charles River would, in fact, be decreased.

The Millers River, a small, substantially degraded remnant of historic tidelands fillings, discharges urban stormwater and overland runoff from adjacent highway and industrial facilities into the Charles River via an artificial subterranean connection. It serves no wetlands functions except for sediment/toxicant retention and nutrient retention and transformation. The Preferred Alternative requires fill in the northern portion of the Millers River, which permits increased setback of the loop ramps from the north bank of the Charles River. The loop ramps shade the Millers River and could result in an indirect loss of resource areas. Filling in a portion of the Millers River would not result in any significant loss of environmental values.

The Charles River Crossing as a whole is a water-dependent project requiring a location in and near wetlands and waterways. As recognized in all of the applicable State and Federal wetlands/waterways regulatory programs, any unavoidable potential adverse effects of fill in the Millers River under the Preferred Alternative must be balanced against the positive benefits of its design to other significant aquatic, water-related, and general environmental values. In this regard, the Preferred Alternative results in an improvement over Scheme Z in so far as aesthetic, open space, future park development, and water-related recreation factors are concerned. These factors are all considerations under Federal Section 404(b)(1) Guidelines (regarding impacts on the aquatic ecosystem). The Preferred Alternative also enhances the availability and visual quality or public access to waterways (a principal policy concern of the state Chapter 91 program). As documented in detail in other sections of this FSEIS/R (i.e., Sections 4.2, 4.9, and the Section 4(f) Evaluation), the reduction in mass of the bridge structures crossing the Charles River, the loop ramp viaducts, and in the number of piers in both the Charles River and the Millers River achieved by the Preferred Alternative will further enhance the successful creation of an integrated waterfront regional park system. These proposed park improvements will link the upper Charles River basin to Boston Harbor, thereby maximizing opportunities for the public to use and enjoy the river and its banks.

4.6 THREATENED OR ENDANGERED SPECIES

There are no known Federal-listed threatened or endangered species known to use the Area North of Causeway Street. The only such species found within the entire Project limits is the peregrine falcon. Locally, its habitat is restricted to the high-rise buildings of downtown Boston. While peregrine falcons have been known to frequent higher bridge structures in other cities, none have been reported in the structure of the existing Charles River high bridge, which will be removed as a result of the Project.

The Atlas Of Estimated Habitat Of State-Listed Rare Wetland Wildlife, produced by the Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife, indicates that no habitat for State-listed rare wetland wildlife species is found in the vicinity of the Charles River crossing. Accordingly, there are no long-term impacts of the Project to threatened or endangered species in the Area North of Causeway Street.

4.7 HISTORIC AND ARCHAEOLOGICAL RESOURCES

This section discusses long-term impacts on historic and archaeological resources of the Preferred Alternative compared to Scheme Z. New effects are identified and discussed.

4.7.1 Historic Resources

4.7.1(a) Affected Environment

This analysis is based on the current inventory of historic resources. The original inventory for the entire Project was prepared in 1982/83 for the 1985 FEIS/R and was updated for the 1991 FSEIS/R. Figure 4.37 shows the locations of the historic resources identified in the Area North of Causeway Street and in the adjacent Central Area, south of Causeway Street, which could be affected by the Preferred Alternative.

MHD has implemented all four of the stipulations of the 1984 Memorandum of Agreement (MOA) among the Section 106 agencies and MHD, which protects historic resources in the Project area. This MOA is included in both the 1985 FEIS/R and the 1991 FSEIS/R for the Project. MHD has also continued consultation with the State Historic Preservation Office (SHPO) and the Boston Landmarks Commission (BLC) through five meetings during the spring of 1993 to confirm effects on historic resources. The Project Conservator, appointed in 1988, and the Section 106 review agencies will continue to review design and construction specifications throughout the Project.

The Advisory Council on Historic Preservation's criteria of Effect and Adverse Effect were used as guidelines for this analysis of effects on historic resources. The definitions for Adverse Effect, No Adverse Effect, construction period effects, and long-term effects remain as articulated in the 1991 FSEIS/R. For each historic resource for which adverse effects have been identified, specific measures to mitigate such effects are described. The basis of these recommendations is the set of mitigating measures stipulated in the MOA and reconfirmed in the 1991 FSEIS/R.

Changes Since The 1991 FSEIS/R. Within the study area, no official changes have been made in the inventory since the 1991 FSEIS/R. However, several potential additions have been identified in the Area North of Causeway Street. The Phipps Street Burying Ground in Charlestown, off Rutherford Avenue, is included in this FSEIS/R because of the northward extension of the Project area. The original granite seawalls in the lower basin of the Charles River, between the Street Railway Viaduct (carrying the MBTA Green Line) and the new Charles River Dam, have also been included in this analysis. The seawalls are being considered in response to a request made in 1992 by the Section 106 cultural resources agencies, after approval of the FSEIS/R in January 1991.

Two possible districts in Charlestown that are newly identified as eligible for the National Register are also considered in this FSEIS/R. The Union Street District and Washington Street District were recommended to the SHPO in 1990 as meeting the criteria for National Register listing. Although they are not contained in the Project's inventory of historic resources, they are described here for purposes of inclusiveness.

4.7.1(b) Long-Term Impacts

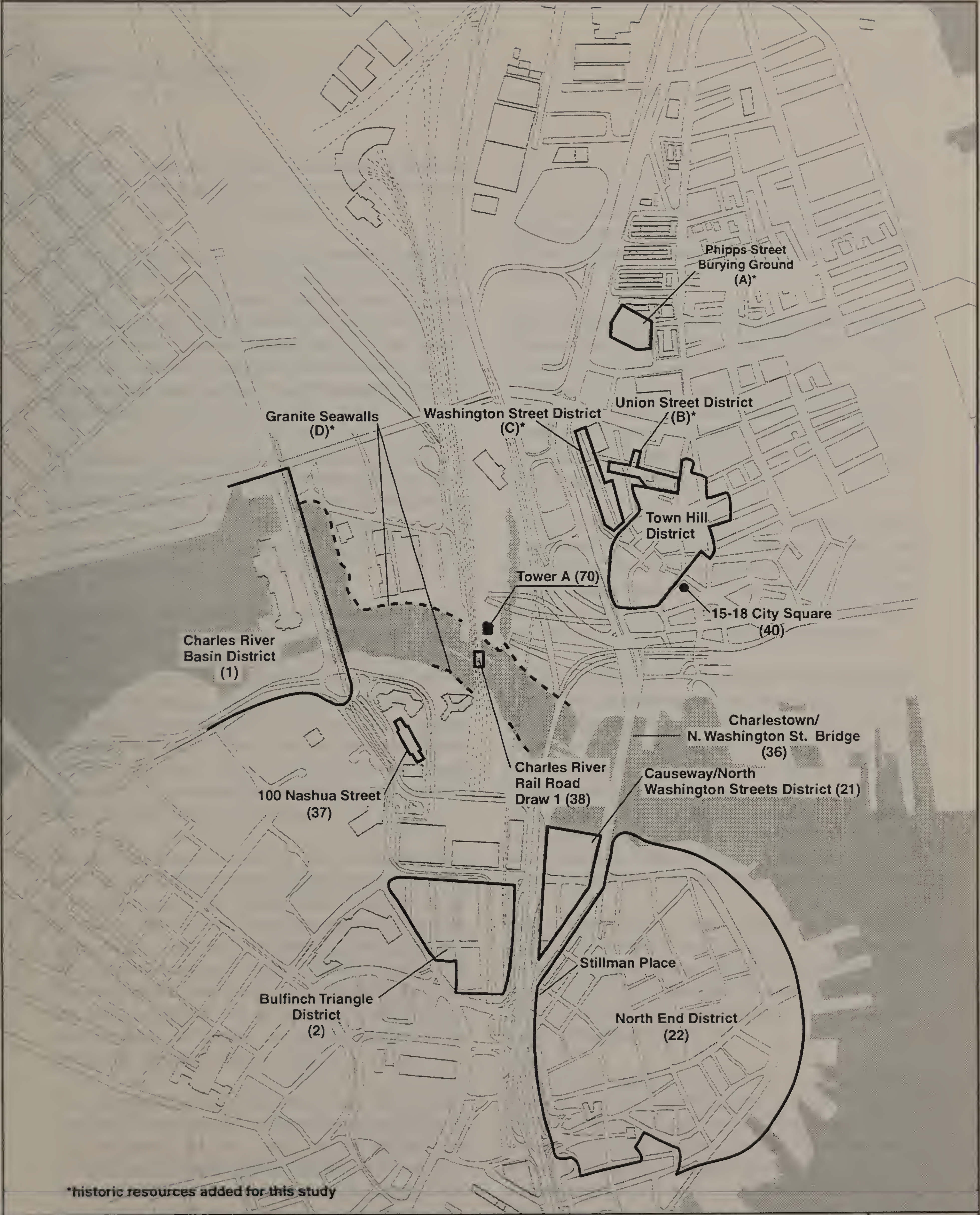
This section identifies all new possible effects of the Preferred Alternative and Scheme Z, positive or negative, to historic resources. The resources, each identified by its inventory number, are described in geographic order, generally from north to south and west to east. Descriptions of resources already identified in the 1991 FSEIS/R are not repeated here; only the changed impacts on them, if any, are identified. The affected environment of the four potential additions to the inventory are also described in this section.

In general, neither the Preferred Alternative nor Scheme Z has adverse long-term impacts that significantly impair the integrity and attributes of historic resources in the affected area. Two areas of limited adverse effects are as follows: (1) bridge footings in both the Preferred Alternative and Scheme Z disturb the granite seawalls in the lower basin of the Charles River, and (2) Scheme Z adversely affects the visual setting of Tower A by locating loop ramps 2 to 4 feet overhead.

Both designs have positive long-term effects on historic resources by removing existing elevated structures proximate to the Town Hill District, Washington Street District, Causeway/North Washington Streets District, Bulfinch Triangle District, and North End District.

Phipps Street Burying Ground (A). The Phipps Street Burying Ground is significant for its role in the early settlement of Charlestown; its association with John Harvard, benefactor of Harvard College (presumably his burial place, the burying ground contains a granite obelisk erected to his memory in 1828 by Harvard graduates); and its collection of 17th through 19th century gravestones and tombs. Listed on the National Register, the burying ground is located off Rutherford Avenue between Miller and Dunstable Streets.

Because it is located outside of the Project limits in the 1991 FSEIS/R, the Phipps Street Burying Ground was not included in the Project's prior inventory of historic resources. However, since the Project limits have been extended northward to Sullivan Square, this historic resource now lies within the Project's secondary impact


Phipps Street
Burying Ground
(A)*
Union Street District
(B)*
Washington Street District
(C)*
Granite Seawalls
(D)*
Town Hill
District
Tower A (70)
15-18 City Square
(40)
Charles River
Basin District
(1)
Charlestown/
N. Washington St. Bridge
(36)
Charles River
Rail Road
Draw 1 (38)
Causeway/North
Washington Streets District (21)
100 Nashua Street
(37)
Stillman Place
Bulfinch Triangle
District
(2)
North End District
(22)
0 200 400 600 800 1000 FEET

*historic resources added for this study

FIGURE

4.37

Historic Resources Existing Conditions

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

corridor. Neither the Preferred Alternative nor Scheme Z produces long-term effects on this property, however, due to its distance from the alignment.

Town Hill District (45). Both the Preferred Alternative and Scheme Z remove the existing elevated I-93 northbound structure, which stands 500 feet from the Town Hill District, and replace it with new structures which are farther away from this historic district. Each design, therefore, has positive long-term effects on the district by improving its visual setting. Neither design has any adverse effects on this district.

Union Street District (B). The Union Street District is characterized by early 19th century masonry housing. It contains notable examples of Federal and Greek Revival double houses and row houses, and includes the birthplace of Col. Charles Devens, Attorney General of the U.S. in Rutherford B. Hayes's Cabinet.

The Union Street District was recommended as meeting the criteria for National Register listing in a study report submitted to the Massachusetts Historical Commission in 1990. Because further study and evaluation has not yet been undertaken, this potential historic district was not included in the Project's prior inventory of historic resources, although it lies within the secondary impact corridor. Neither the Preferred Alternative nor Scheme Z produces long-term effects on this district, however, due to its distance from the alignment.

Washington Street District (C). The Washington Street District comprises an enclave of modestly scaled masonry row houses and single family frame dwellings dating from circa 1804 to 1840. The district was recommended as meeting the criteria for National Register listing in a study report submitted to MHC in 1990. Because further study and evaluation has not yet been undertaken, this potential district was not included in the Project's prior inventory of historic resources, although it lies within the secondary impact corridor.

Like the adjacent Town Hill District, both the Preferred Alternative and Scheme Z remove the existing elevated I-93 northbound structure, which stands 500 feet from the Washington Street District, and replace it with new structures which are farther away from this potential historic district. Each design, therefore, has positive long-term effects on the district by improving its visual setting. Neither design has any adverse effects on this district.

15-18 City Square (40). Because of its distance from the alignment in both the Preferred Alternative and Scheme Z, there is no long-term effect on this historic building.

Charles River Basin District (1). In both the Preferred Alternative and Scheme Z, the existing traffic rotary at Leverett Circle is removed and its traffic movements reconfigured. The east curb line of Storrow Drive is moved 20 feet toward the Charles River Park apartments in both the Preferred Alternative and Scheme Z. The Esplanade, on the river side of Storrow Drive, is not affected in either design.

The contributing historic structures located within the area of potential effects include the Streetcar Railway Viaduct, the MDC Police Headquarters and Lock House, and the old Charles River Dam. The Preferred Alternative and Scheme Z have no adverse effect on these historic resources or on the historic character of the district.

Granite Seawalls In The Lower Basin Of The Charles River (D). The lower basin includes the portion of the Charles River between the Streetcar Railway Viaduct (which forms the eastern boundary of the Charles River Basin Historic District) and the new Charles River Dam. Potential historic resources newly identified in this area include a nearly continuous granite seawall on the northern (Cambridge/Charlestown) side of the river, which extends from the Streetcar Viaduct to the dam, and fragments of a granite seawall on the Boston side of the river.

These seawalls are not now included in the adjacent Charles River Basin Historic District. As part of the Section 106 review process for the Charles River Crossing DSEIS/R, MHC determined that these seawalls have sufficient integrity and significance to be eligible for listing in the National Register.

Filling of the mudflats and marshes of the Charles River began in the late 18th century on the Cambridge side, and in the mid-19th century on the Boston side. The old Charles River Dam was built between 1903 and 1910 to control the water level of the river basin and to allow for a recreational reserve upstream. With the development of this area as a major metropolitan park, the Streetcar Railway Viaduct was added in 1910, in part to hide the unsightly railroad yards and wharves downstream. The granite seawalls in the lower basin were built circa 1927, as part of reconfiguration of the area to accommodate the new North Station.

In both the Preferred Alternative and Scheme Z, the construction of bridge footings disturbs portions of the seawalls east of the MBTA commuter railroad bridge (Charles River Railroad Draw 1). This effect was present but not identified for Scheme Z, and the effect is similar in the Preferred Alternative.

As part of the overall mitigation program that addresses regulatory requirements for the new Charles River Crossing, a new water feature is added on the north bank of the Charles River. Construction of this new feature involves potential disturbance to one small section of the historic seawalls in this area (approximately 50 lf).

Tower A (70). By relocating the viaduct loop ramps away from Tower A, the Preferred Alternative reduces the adverse visual impacts on the structure that are described in the 1991 FSEIS/R. Scheme Z retains viaduct ramps directly over the historic building. The building continues to be operational in both designs. In the Preferred Alternative, the viaduct loop connecting I-93 northbound and Route 1 northbound is located approximately 30 feet away from Tower A; no long-term effects to the building are expected. In Scheme Z, overhead viaduct ramps connecting I-93 northbound and Route 1 northbound negatively affect the visual setting of Tower A by passing 2 to 4 feet overhead and obstructing views of the historic building.

Charles River Railroad Draw 1 (38). In the Preferred Alternative, the bridges for the Charles River Crossing are located approximately 50 to 80 feet downstream of the Charles River Railroad Draw 1, similar to Scheme Z. Scheme Z was determined to have no long-term effects on this historic bridge, and no long-term effects are therefore expected from the Preferred Alternative.

Charlestown/North Washington Street Bridge (36). Because of its distance from the alignment in both the Preferred Alternative and Scheme Z, there is no long-term effect on this historic structure.

100 Nashua Street (Registry Of Motor Vehicles) (37). The Preferred Alternative locates a tunnel from Storrow Drive underneath the Registry building, whose facade system is already in fragile condition. Scheme Z was determined to have no long-term effects on the historic Registry building.

In addition to the tunnel underneath, the Preferred Alternative locates a new at-grade off-ramp to Nashua Street within 20 feet of and parallel to the rear of the Registry building. The resulting change in the building's visual setting will not substantially impair its physical integrity or historic attributes, and no adverse effect is predicted.

The location and design of the ventilation building near the Registry building has potential impacts to its visual setting. In the Preferred Alternative, a proposed ventilation building is located below grade and located approximately 180 feet away and diagonally across the street, away from the Nashua Street facade of the building. Due to the maximum building height allowed by current zoning, the height of the exhaust stacks is assumed to be 330 feet. Recognizing that the setting for the Registry building is already heterogeneous in siting, massing, materials, character, and use, the long-term visual effect of the ventilation building stacks is not expected to be adverse. Scheme Z requires no ventilation building.

Causeway/North Washington Streets District (21). Scheme Z was determined to have no long-term adverse effects on this district, and the Preferred Alternative has no change in long-term effects. Both the Preferred Alternative and Scheme Z have a long-term positive effect by removing the existing Central Artery viaduct and thereby enhancing the district's setting. Joint development guidelines for this area will contain preservation criteria to enhance the character and integrity of the district.

Bulfinch Triangle District (2). Scheme Z was determined to have no long-term adverse effects on this district, and the Preferred Alternative has no change in long-term effects. Both the Preferred Alternative and Scheme Z have a long-term positive effect by removing the existing Central Artery viaduct and thereby enhancing the district's setting. Joint development guidelines for this area will contain preservation criteria to enhance the character and integrity of the district.

North End District (22). Scheme Z was determined to have no long-term adverse effects on this district. Both the Preferred Alternative and Scheme Z have a long-term positive effect by removing the existing Central Artery viaduct and thereby enhancing the district's setting. Joint development guidelines for this area will contain preservation criteria to enhance the character and integrity of the district.

The Preferred Alternative includes new long-term effects on historic attributes of the district due to the proximity of the proposed surface road to 2-6 Stillman Place. Scheme Z contains a northbound surface road that is located approximately 35 feet away from Stillman Place, with no adverse effect on the historic streetscape. In the Preferred Alternative, the addition of a new downtown on-ramp moves the northbound surface road within 10 to 15 feet of the closest of these buildings. This move requires resurfacing a portion of Stillman Place as part of the construction of the new surface road. No long-term adverse effects are predicted from the resurfacing, which will be mitigated as described below. The closer proximity of the surface road in the Preferred Alternative is offset by the fact that traffic volume will be lower than with Scheme Z.

4.7.1(c) Summary

Generally, both the Preferred Alternative and Scheme Z have no adverse long-term effects that significantly impair the integrity and attributes of the historic resources in the affected area.

4.7.1(d) Mitigation

Granite Seawalls In The Lower Basin Of The Charles River (D). The adverse effects of disturbing sections of these seawalls for construction of bridge footings are mitigated through Stipulation 2 of the MOA, which governs similar work at Fort Point Channel. This stipulation provides specific design guidelines for the reuse of existing material and for the characteristics of new construction. It also calls for the Project Conservator's review of design and construction specifications. Any portions of the seawalls to be disturbed would therefore be disassembled and rebuilt with existing materials, or in-kind, to match existing conditions. All work will comply with the Secretary of the Interior's *Standards for the Treatment of Historic Properties.* As a result of such mitigation, potential long-term adverse effects on this resource will be minimized or avoided in the Preferred Alternative and Scheme Z.

Further study will be undertaken to determine the appropriate design for the new water feature in the new Charles River Basin, which is proposed as part of the mitigation program for the Charles River Crossing. In compliance with Section 106 review, MHD will continue to work with cultural resources agencies to identify, develop, and implement appropriate mitigation measures for the granite seawalls, prior to the commencement of any work. For example, the design for access to the new water feature will minimize impact to the historic attributes of the seawall in this location and elsewhere.

100 Nashua Street (Registry Of Motor Vehicles) (37). As a result of the tunnel located underneath the Registry building in the Preferred Alternative, underpinning of the building is required, along with preventive treatment for the facade. Potential long-term effects from settlement and vibration (both construction- and traffic-related) are mitigated by stabilization of the facade, including, if necessary, removal of the facade, underpinning of the building, and restoration of the facade with existing or in-kind materials.

Further study of the existing design and physical condition of the facade system will be undertaken to determine the appropriate extent and methods of required preservation work. In compliance with Section 106 review, the Project will continue to work with cultural resources agencies to identify, develop, and implement appropriate mitigation measures for the Registry building, prior to the commencement of any work.

Under Stipulation 4 of the MOA, the Project Conservator, SHPO, and BLC will review design and construction specifications for this work. As a result of these mitigation measures, there will be no long-term adverse effect on the historic building. Moreover, by addressing a serious pre-existing problem, the Preferred Alternative will improve the long-term condition of the building.

The visual impact of the ventilation building stacks is mitigated through the design review process established by Stipulation 4 of the MOA. Joint development guidelines for this area will include preservation criteria to enhance the character and integrity of historic resources such as 100 Nashua Street.

North End District (22). In the Preferred Alternative the surface road adjacent to Stillman Place is two lanes wide, while Scheme Z features a three-lane surface road. Traffic levels are substantially lower (by 15 to 40 percent, depending on the time of day) in the Preferred Alternative compared to Scheme Z. These reductions in traffic are due to the same design change which requires the Surface Artery to be aligned closer to the row houses.

The surface road design is further mitigated through review by the Project Conservator, SHPO, and BLC, in compliance with Stipulation 4 of the MOA. To mitigate the potential adverse effect of the required resurfacing of Stillman Place, existing granite paving blocks will be reused or replaced in kind, and existing granite bollards will be removed, stored, and replaced, in compliance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties*. As a result of these mitigating conditions, the alteration in the setting of Stillman Place is not expected to substantially impair the integrity or attributes of the historic streetscape, and no long-term adverse effect is predicted.

4.7.2 Archaeological Resources

4.7.2(a) Background

Presented in this section is the inventory of potential archaeological resources for the Charles River Crossing in the Area North of Causeway Street for the Preferred Alternative and Scheme Z. These resources, when fully evaluated, could be eligible for listing on the National Register of Historic Places (NR). A description of the potential effects of the Project on these resources and a discussion of proposed methods of evaluating and mitigating any potential adverse effects are also included.

The process of identification and evaluation of archaeological resources that might be affected by the Central Artery/Tunnel Project began in 1982 with preparation of a Phase I, Step I archaeological survey report for the Project (which at that point extended to the Gilmore Bridge in Charlestown). The 1984 Section 106 Memorandum of Agreement signed by FHWA, MHD, SHPO, the BLC, and the Advisory Council on Historic Preservation (Advisory Council) stipulated that a Phase I, Step II/Phase II archaeological investigation of the Project's proposed area of environmental impact be conducted in consultation with MHD, SHPO, and BLC.

The Phase I, Step II survey was completed and approved by these parties in 1988. It recommended that a Phase II field investigation be conducted to determine the location, extent, integrity, and significance of archaeological resources in specific areas likely to contain such resources. The Phase II field investigation was completed in 1989 and its recommendations were reviewed and approved by MHD, FHWA, SHPO, and BLC in August 1989. Three NR-eligible archaeological sites were discovered within the Artery's path, and a Phase III data-recovery program was recommended to take place prior to construction, in accordance with 36 CFR 800.4. The Phase III data recovery program was begun in March 1992; field investigations on two of the sites were completed in 1992 and 1993, while the third is slated to be finished by the spring of 1994.

The identification and evaluation of archaeological resources that might be affected by the portion of the Project known as the Charles River Crossing began with the CANA project and was followed by the 1991 FSEIS/R. The latter document included the Scheme Z design and its impacts on the area south of Gilmore Bridge.

The most recent archaeological resource evaluation process started in 1993 with a Phase I, Step II archaeological survey report, completed in September 1993. The selection in November 1993 of the Preferred Alternative for the Charles River Crossing prompted a final analysis of impacts to archaeological resources within the areas to be affected. The Preferred Alternative's area of impact extends from the northern Project unit near Sullivan Square to Commercial Street/Clinton Street, at the southern boundary of the North End study area; this option occupies largely the same area as Scheme Z.

As mentioned above, the area south of the Gilmore Bridge was covered previously in the 1991 FSEIS/R and the CANA project. The identification of potentially significant archaeological resources in this area has not changed. The 1993 reconnaissance report focused on the area north of the Gilmore Bridge to Sullivan Square, which is an addition to the original study areas.

This evaluation has been coordinated with MHC (see Appendices to Section 4(f) Evaluation).

4.7.2(b) Affected Environment

The Phase I, Step II archaeological survey for the Charles River Crossing follows the guidelines already established in the 1988 Phase I, Step II survey and is similar to it in research design and methodology. The research, walkover, and analysis of the results are intended to identify:

- the kinds of activities that occurred in the study areas before filling took place
- the subsequent use of filled land surfaces

- the type and location of known and expected archaeological resources
- utilities and other sources of disturbance

The objective is to develop a land-use history of the areas, to identify potentially significant archaeological resources, and to recognize areas where additional research is needed.

The 1993 study utilizes the previously defined study areas and study blocks and the same categories of potentially significant historic archaeological resources; background research includes the use of available geotechnical reports and historic fill records, company records, historic atlases, insurance and other maps, previously published reports, and oral informants. Libraries, archives, State repositories, and other sources provided the abovementioned material. The result is a Phase I, Step II draft report (Timelines 1993).

The reconnaissance survey addresses three study areas and nine study blocks and their intervening streets, traffic islands, or bodies of water (the Charles River). In one of the new study blocks (CH02, in Charlestown) the construction crosses part of the original 17th-century Boston land mass, which has been enlarged by the continuous filling of flats, marshes, creeks, bays, and the Harbor.

Information on the history of land use in each study block is evaluated using the NR Criteria of Significance and integrity. The categories of expected archaeological resources described in the Project's research design as having the potential to meet these criteria are the following (from Elia and Seasholes 1989:22-32):

- Prehistoric Sites: Any reasonably intact prehistoric site could be considered significant on the basis of its ability to offer important information for understanding the prehistory of the region.
- Settlement and Structures: In general, intact archaeological resources relating to settlement and structures that date to the earliest periods of Boston's history (1620 to 1830) are likely to be highly significant, as little is known about these periods.
- Wharves and Wharf-Related Sites: Intact remains and related information regarding Boston's maritime history are likely to be of significance.
- Landfill: In general, small-scale landfills dating to the 17th and 18th centuries may be considered potentially significant, whereas later land-filling operations on a large scale are not likely to be significant.
- Manufacturing and Industrial Sites: As a general rule, intact archaeological resources of manufacturing and industrial sites are most likely to be of significance for the period from initial settlement through the Early Industrial Period (ca. 1630 to 1870).
- Transportation-Related Sites: Archaeological resources relating to the technological aspects of the early period of railroads (ca. 1835 to 1870) and canals are considered to be potentially significant.

Of the nine study blocks considered in the survey, six were found to contain (1) no intact archaeological resources as a result of construction activities or other types of disturbances, (2) archaeological resources that are not considered significant according to the established criteria, or (3) resources that will not be affected by the two designs currently under consideration.

The three remaining study blocks are located in areas that were extensively filled during the 19th and 20th centuries, and later developed; these study blocks could contain archaeological resources considered potentially significant.

Study Block CH02 is located within Charlestown study area. This study block is bounded by the Gilmore Bridge on the south, the fence abutting the I-93 viaduct/MBTA Orange Line tracks on the east, the end of the existing viaduct (opposite the Hood Plant on Rutherford Avenue) on the north, and the MBTA commuter railroad tracks on the west. Historical and geotechnical research for the study block identifies the following expected archaeological resources:

- possible Prehistoric and Contact period sites within the original 17th-century shoreline
- piers for construction of the Boston and Maine Railroad (ca. 1845), wooden structure

- brick round houses, and a frame repair shop (1865 to 1927)
- fill (1875 to 1887)
- a coal trestle (ca. 1902)

Study Blocks WE05 and WE06 are located within the West End study area. These study blocks are bounded by Lomasney Way, Cotting Street, Nashua Street, and the Surface Road. Historical research for the study block identifies the following expected archaeological resources:

- fill (1832 to 1838)
- the cellars, backlots, and rear alleys of one- to three-story tenement buildings constructed in the mid-19th century

4.7.2(c) Archaeological Resources Affected By The Preferred Alternative

The research identifies portions of three study blocks, CH02, WE05, and WE06, as possessing potentially significant archaeological resources that the Preferred Alternative construction will affect (see Figure 4.38).

CH02. The Preferred Alternative clearly defines the northern end of the Charles River Crossing's design by including two elevated service roads and an off-ramp to Cambridge Street in Charlestown. These structures cross sections of the original shoreline of the Millers River embayment. The shore and near-shore settings may contain Prehistoric and/or Contact period archaeological sites. Any relatively intact Prehistoric or Contact period site is potentially significant. The relatively slow rate of Historic-period development of the study block until the 1870s, followed by rapid filling of the entire area, suggests that preservation of these sites is possible. Moreover, because the Historic-period fill in this area is 6 to 8 feet thick, the late 19th and early 20th century construction of railroad yards and related facilities may not have significantly affected surviving archaeological sites; the comparatively light residential use of the area has resulted in the installation of relatively few underground utilities, further reducing disturbance to the area of the past century. Therefore, any Prehistoric and/or Contact period archaeological sites in the Preferred Alternative alignment have a moderate to high probability of surviving intact.

The piles for the service roads and off-ramp are currently expected to be 50 to 60 feet deep, with pile caps typically 15 by 20 feet in width and 6 to 8 feet deep; piles will be driven every 100 feet. Construction impacts to potential Prehistoric and/or Contact period sites will therefore be intermittent and limited in area. Archaeological monitoring of the geotechnical borings to determine the presence of undisturbed original land surfaces, features, and/or artifacts associated with Prehistoric and Contact period sides is recommended for this area.

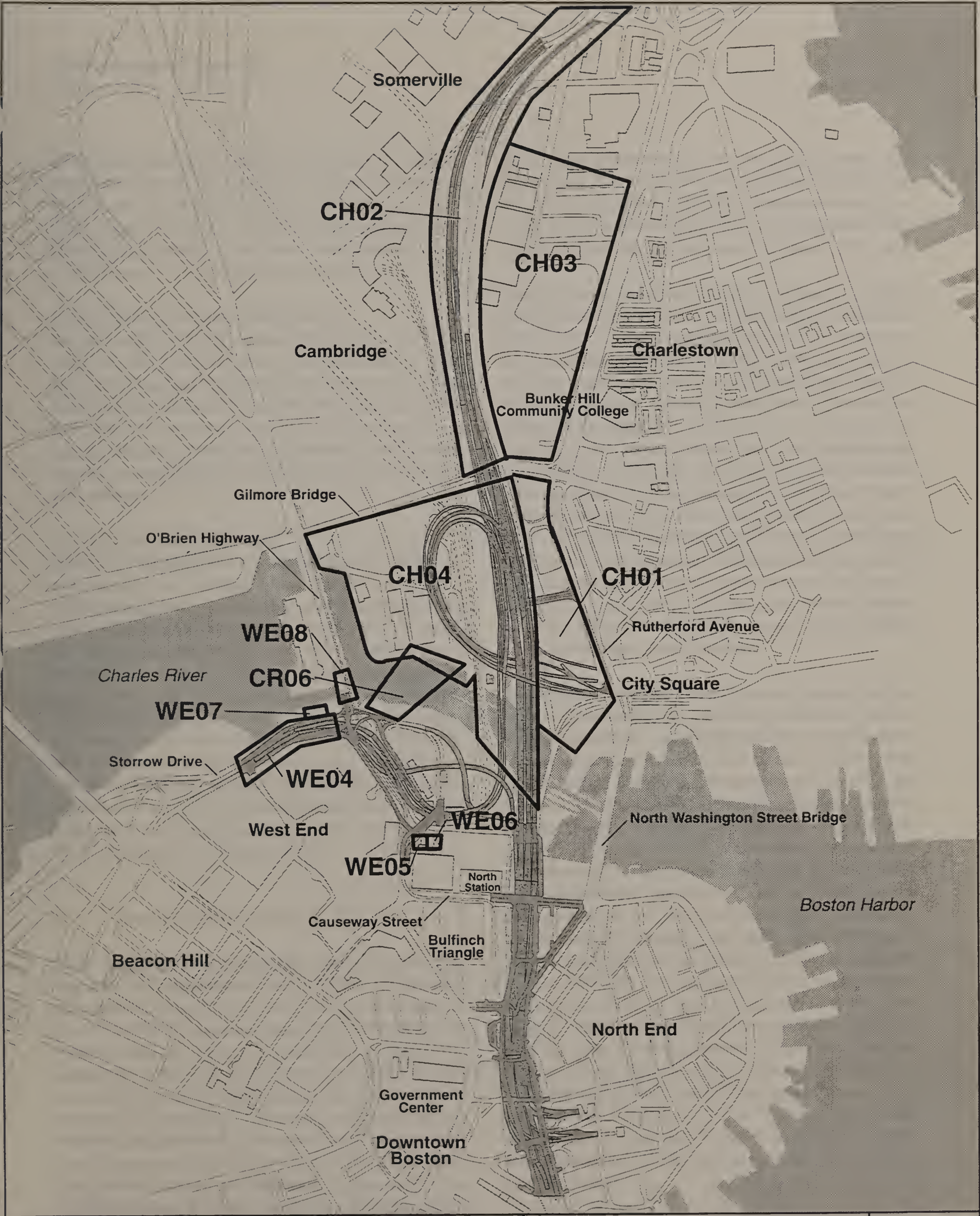
WE05 And WE06. The Preferred Alternative involves realignment of existing surface roads between Nashua Street and Lomasney Way, in the Study Blocks WE05 and WE06. The existing streets and their realignment cross two former blocks of tenement buildings, separated by the former Billerica Street, that housed Jewish, Italian, and Irish immigrants. The tenement buildings were constructed on fill between 1832 and 1852, and at present only one tenement building remains standing, the lone surviving architectural component of the historic West End. Despite their destruction, the tenements represent potential archaeological sites, consisting of truncated cellars and backlots. These sites have medium to high significance and integrity (Elia and Seasholes 1989:102).

The Preferred Alternative realignment of the existing streets involves only minor changes to curb lines. These changes are not expected to affect potential historic sites to any significant degree. Therefore, monitoring during the construction phase of the Project is recommended for these study blocks. However, any additional modification of the Preferred Alternative design will require that these recommendations be reevaluated.

4.7.2(d) Archaeological Resources Affected By Scheme Z

The reconnaissance survey identifies portions of CH02 as possessing potentially significant archaeological resources that the Scheme Z construction will affect.

The viaduct north of the Gilmore Bridge crosses sections of the original shoreline of the Millers River embayment. The shore and near-shore settings may contain potentially significant Prehistoric and/or Contact period archaeological sites. The Scheme Z viaduct structure threatens impacts to these potential Prehistoric and/or Contact period sites analogous to the impacts in


Somerville
CH02
CH03
Cambridge
Charlestown
Bunker Hill Community College
Gilmore Bridge
O'Brien Highway
CH04
CH01
Rutherford Avenue
WE08
Charles River
CR06
City Square
WE07
Storrow Drive
WE04
WE06
North Washington Street Bridge
West End
WE05
North Station
Boston Harbor
Causeway Street
Bulfinch Triangle
Beacon Hill
North End
Government Center
Downtown Boston

FIGURE

4.38

Preferred Alternative
Archaeological Study Area

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET

CH02 described for the Preferred Alternative. Archaeological monitoring of geotechnical borings to determine the presence of undisturbed original land surfaces, features, and/or artifacts associated with Prehistoric and Contact period sites for this area would be needed, under Scheme Z, as in the Preferred Alternative.

4.7.2(e) Environmental Consequences

As previously described, portions of the CH02 study block would be adversely affected by the placement of piles required for the construction of the viaduct, service roads, and off-ramp planned for both the Preferred Alternative and Scheme Z. However, these potential adverse effects may be mitigated by measures discussed in the following section, as stipulated by the Section 106 Memorandum of Agreement.

4.7.2(f) Mitigation Measures

MHD will mitigate these potential adverse effects by monitoring the borings to be conducted for the geotechnical program. The analysis of these borings will provide information to evaluate the presence of undisturbed land surfaces, features, and/or artifacts associated with Prehistoric and/or Contact period sites. The archaeological work will include research, field work, laboratory analysis, conservation of fragile specimens, report preparation, and recommendations on the need for further archaeological investigations, if any. The program will be reviewed and approved by the SHPO before implementation. This work will be completed well before construction of the support piles in the area between Cambridge Street and the Gilmore Bridge.

4.8 HAZARDOUS WASTE SITES

MHD and the Massachusetts DEP have developed protocols for the assessment and characterization of soils and groundwater along the Project alignment. As detailed in the 1991 FSEIS/R, this assessment and characterization process seeks to identify the nature and extent of contamination within each parcel along the Project right-of-way (ROW) both through historic record searches and extensive field sampling. The purpose of this process is to identify and delineate any areas of the ROW which are heavily contaminated with petroleum or hazardous materials so that removal and treatment or disposal of contaminated soils or hazardous wastes can be performed, in accordance with Federal and State requirements. To date, no hazardous waste sites or areas of extensive soil or groundwater contamination have been identified through this process in the Area North of Causeway Street. As described in the 1993 DSEIS/R, sample results so far indicate the presence of oil and other soil contaminants consistent with the railroad and industrial history of the area.

The assessment and characterization process proceeds in three phases: initial assessment (including research into historic uses of the site and records of prior releases of oil or hazardous material), field characterization through soil and groundwater testing, and delineation of heavily contaminated areas. Reports are prepared for each of the phases and submitted to DEP for review and approval. Following these steps, detailed plans and specifications are provided to DEP, showing the nature and extent of contamination, and the measures for containment, treatment, and/or removal of contaminated soils. These plans, which require DEP approval, also address the treatment or disposal of groundwater encountered during excavation. During construction, compliance with the plans is monitored, and all excavated soils are sampled before disposal. All soils are tracked by means of bills of lading or waste manifests, as appropriate.

As part of the assessment and characterization process, MHD has conducted a record search for known sites requiring remediation under either the Resource, Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensational Liability Act (CERCLA), as amended. This search revealed no known or listed Federal remedial sites under either RCRA or CERCLA. In addition, MHD has conducted sampling of soils along the north bank of the Charles River in Cambridge and Boston (Charlestown). Five soil borings were performed along the riverbank, to a depth between 35 and 50 feet. Two borings were performed on the south bank, in the vicinity of the existing I-93 bridge, to depths of 34 and 60 feet. The results of chemical analyses performed on soils from these borings indicated the presence of metals and petroleum hydrocarbons in the historic fill materials and in native soils, at levels generally typical of urban soils. Two borings showed levels of contaminants significantly higher than typical levels, in native material at depths of 35 to 37 feet. None of the samples showed elevated levels of contaminants which would indicate a need for special measures to remove or treat the soils.[12]

Previous soil borings, performed in the areas that would be affected by Scheme Z, showed the presence of elevated levels of metals, petroleum hydrocarbons, and polynuclear aromatic hydrocarbons (PAH). Levels of metals detected in these borings were below the thresholds established by RCRA for hazardous wastes. Removal and disposal of these soils therefore does not appear to be subject to Federal hazardous waste regulations. Levels of petroleum contamination in two borings were high enough to warrant further definition of the extent of contamination. These borings were located in areas historically associated with railroad yard activity.

The limits of the Project area for this FSEIS/R have been extended northerly along the I-93 corridor from just south of the Gilmore Bridge in Cambridge to near Sullivan Square in Charlestown, near the Somerville border. This additional study area consists of land uses that are predominantly transportation and business/commercial. MHD plans to assess and characterize soils in this area under the program outlined above.

The long-term impacts on the Preferred Alternative of soil and groundwater contamination with oil or hazardous materials will be determined once further testing and characterization is completed.

4.9 VISUAL IMPACTS

This section describes visual impacts of the Preferred Alternative and Scheme Z in the Area North of Causeway Street and discusses proposed mitigation and enhancement measures. The visual impacts include views of the Project from the surrounding areas, and views of the surrounding areas from the Project. This description of the visual impacts of the Preferred Alternative and Scheme Z assumes the construction of bridges as described in Chapter 2. The final bridge selection is subject to a FHWA bridge design type study. Refer to Figures 4.39 through 4.41, and Table 4.30 for comparisons of visual impacts.

4.9.1 Affected Environment

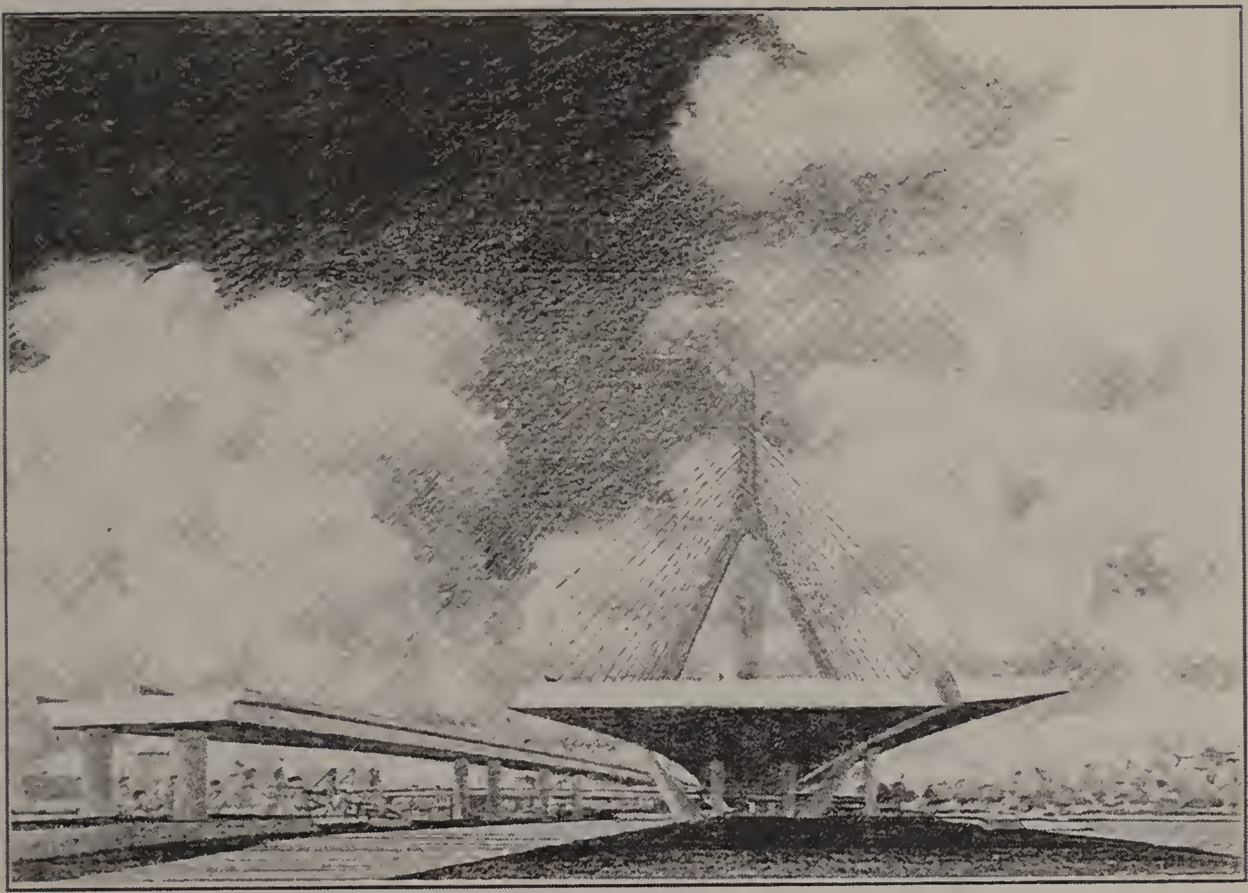
Currently, the Area North of Causeway Street is dominated by steel viaducts, inaccessible open spaces, parking lots at grade, and industrial warehouses. The area is visible from surrounding bridges and viaducts. On the west, the historic Street Railway Viaduct carries the elevated MBTA Green Line. On the east, the North Washington Street bridge connects Rutherford Avenue in Charlestown with North Washington Street in Boston. On the north, the relatively new Gilmore Bridge carries traffic between Charlestown and Cambridge over railroad yards. On the south, the area is defined by the Storrow Drive connector viaduct to I-93. Mid-rise buildings are located along Causeway Street including the aging North Station/Boston Garden building and the new O'Neill Federal Office Building. Finally, the elevated I-93 traverses the Lower Charles River Basin. The proposed MDC parkland master plan, New Boston Garden, and other proposed development in the area would substantially alter the visual setting in the lower Charles River Basin area. At present it is primarily pedestrians and railroad passengers who view the area at ground level; to a lesser extent motorists and boaters have ground-level views.

4.9.2 Impacts

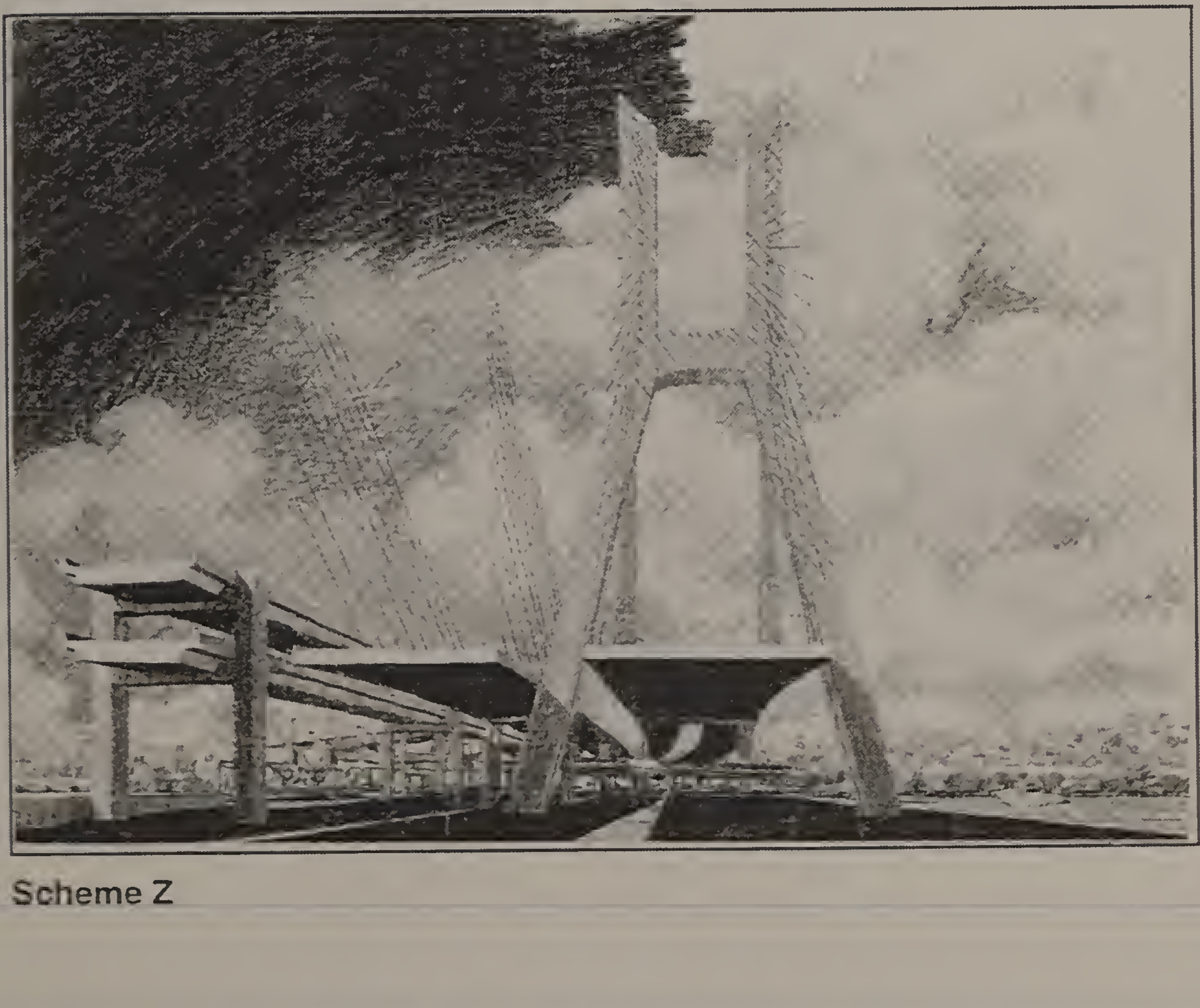
The Preferred Alternative and Scheme Z reconfigure approximately 165 acres of semi-industrial and underused land and waterways near downtown Boston. The immediate area will include four major physical components: riverfront parkland, river uses, transportation infrastructure, and several new buildings. The river crossing is partly visible from the surrounding residential, commercial, and institutional communities. These components of the immediate area, and the surrounding communities from where the components are visible, together constitute the visual impact environment.

The impacts on the components of this environment include the views of and from: (1) the road, (2) the waterways, (3) the parkland, and (4) the Project-related building structures.

- View of and from the road: The Preferred Alternative and Scheme Z include unique traffic moves along the highway system (tunnels, surface, and viaduct). Highways and roads have three sources of visible impacts; traffic volume and road design, including number of lanes, lane width, curvature, and sight lines; the planning of the surrounding landscape and the abutting parcel development for efficient and compatible traffic circulation; and pedestrian circulation. A bridge-type study completed in 1991 identified various types of bridges for Scheme Z, three of which remain feasible for the Preferred Alternative: tied arch, parallel chord truss, and cable-



Preferred Alternative



Scheme Z

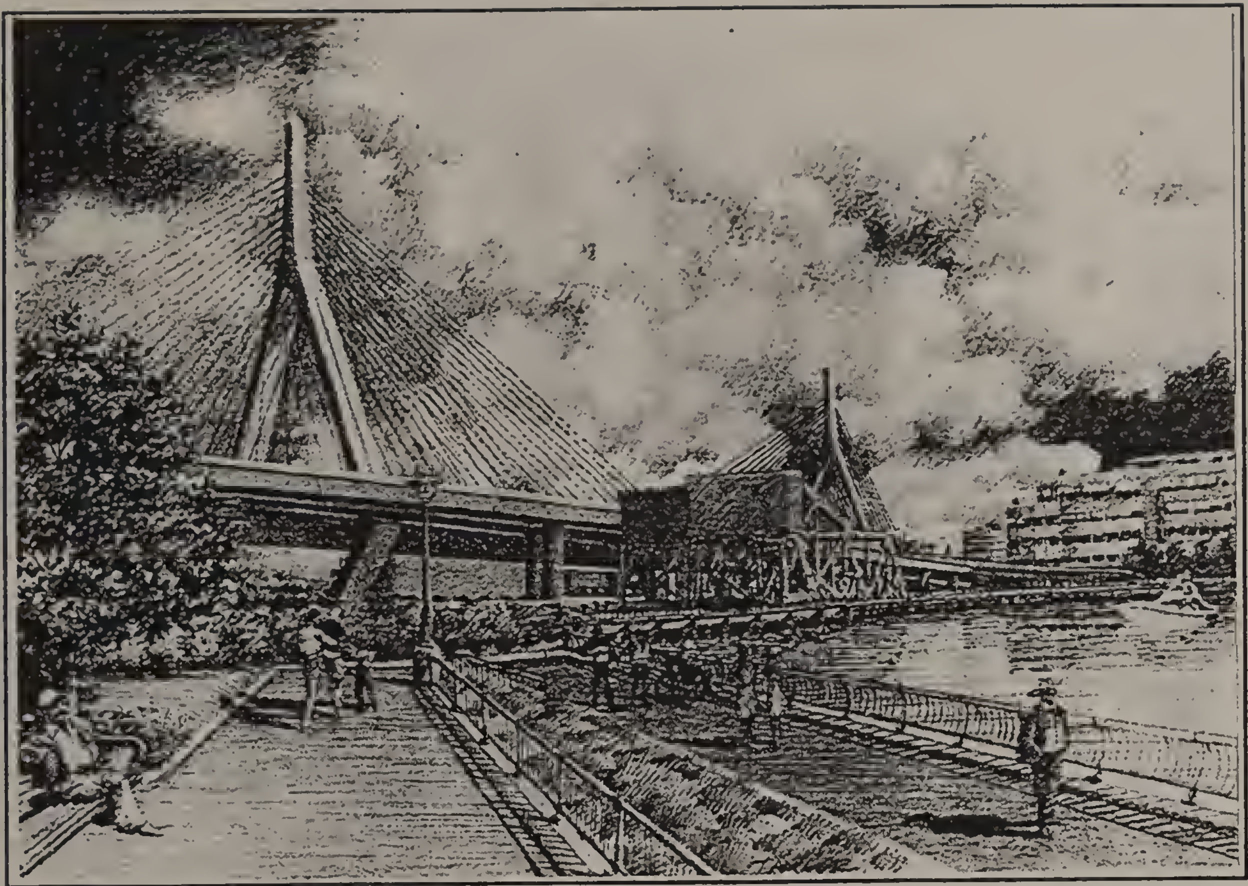
FIGURE

4.39

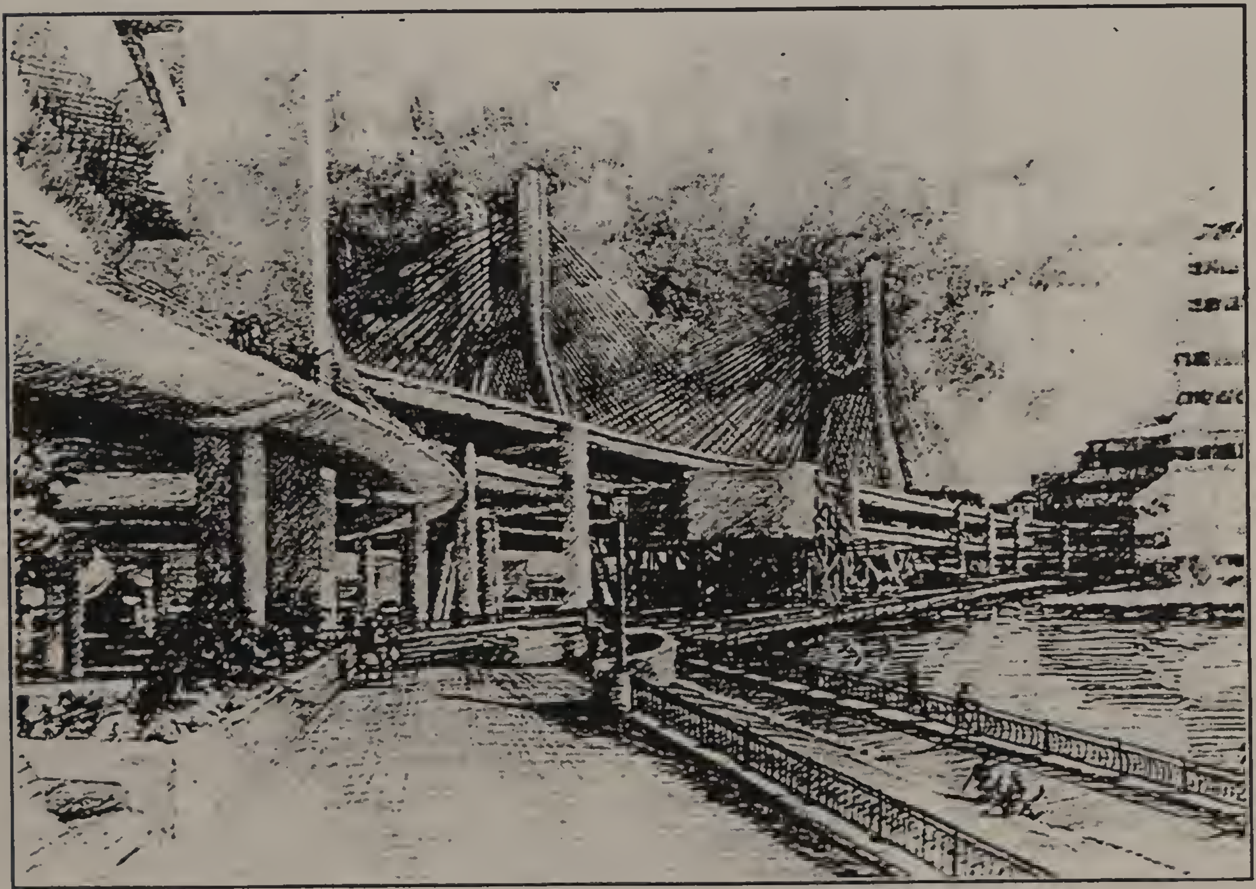
Sectional View Looking North From South Bank: Preferred Alternative and Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT



Preferred Alternative



Scheme Z

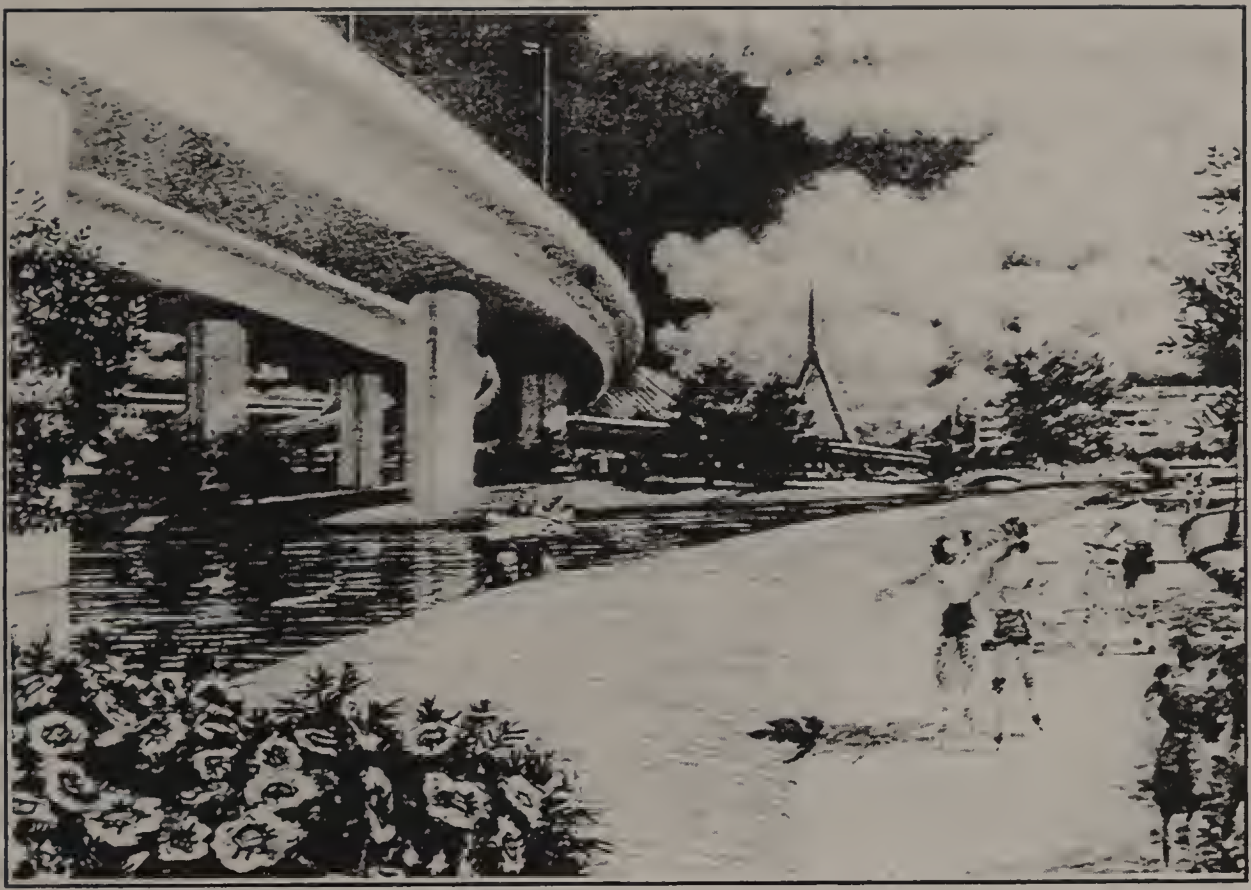
FIGURE

4.40

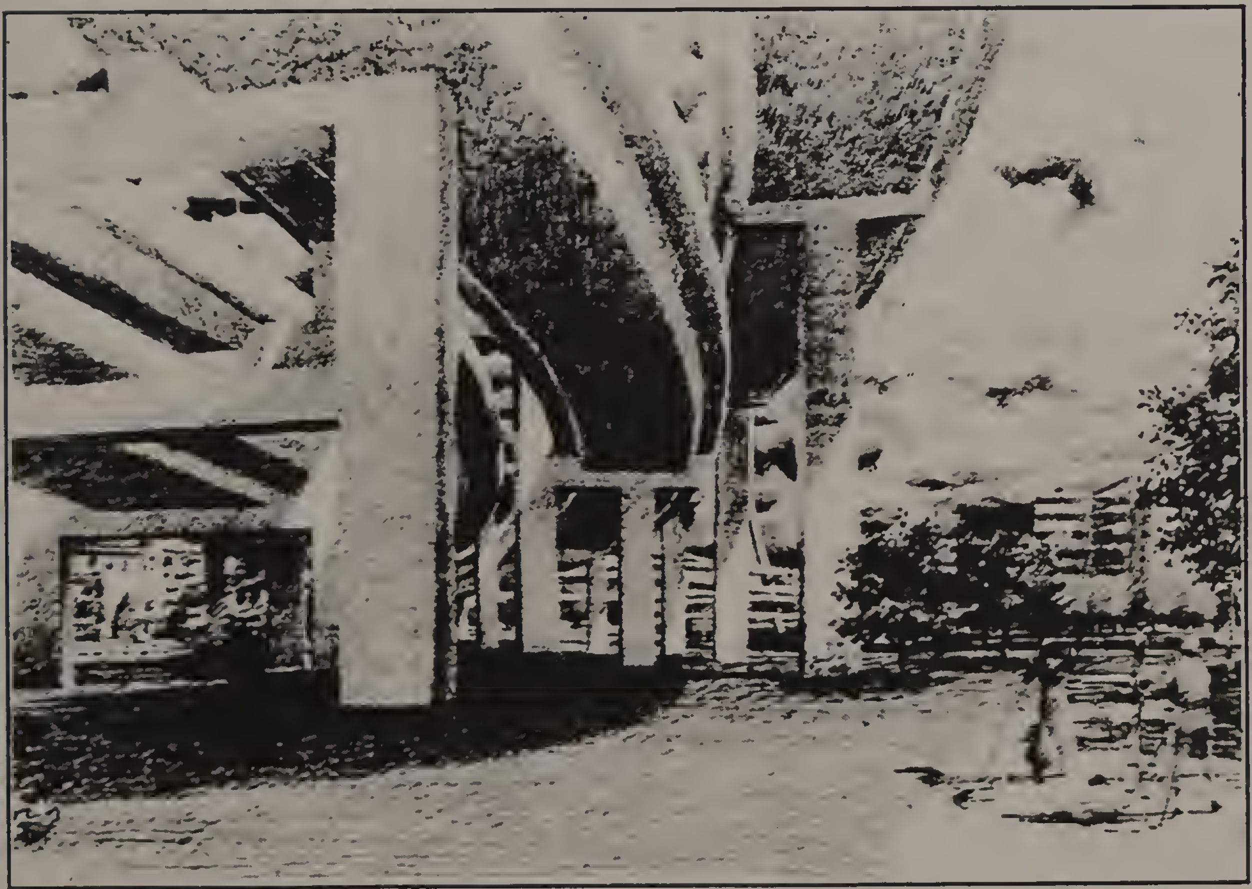
View Of Charles River Bridge
From North Bank Looking East:
Preferred Alternative and Scheme Z

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT



Preferred Alternative



Scheme Z

FIGURE

4.41

View of Charles River Loop Ramps And Bridge From Cambridge: Preferred Alternative and Scheme Z

Charles River Crossing FSEIS/R

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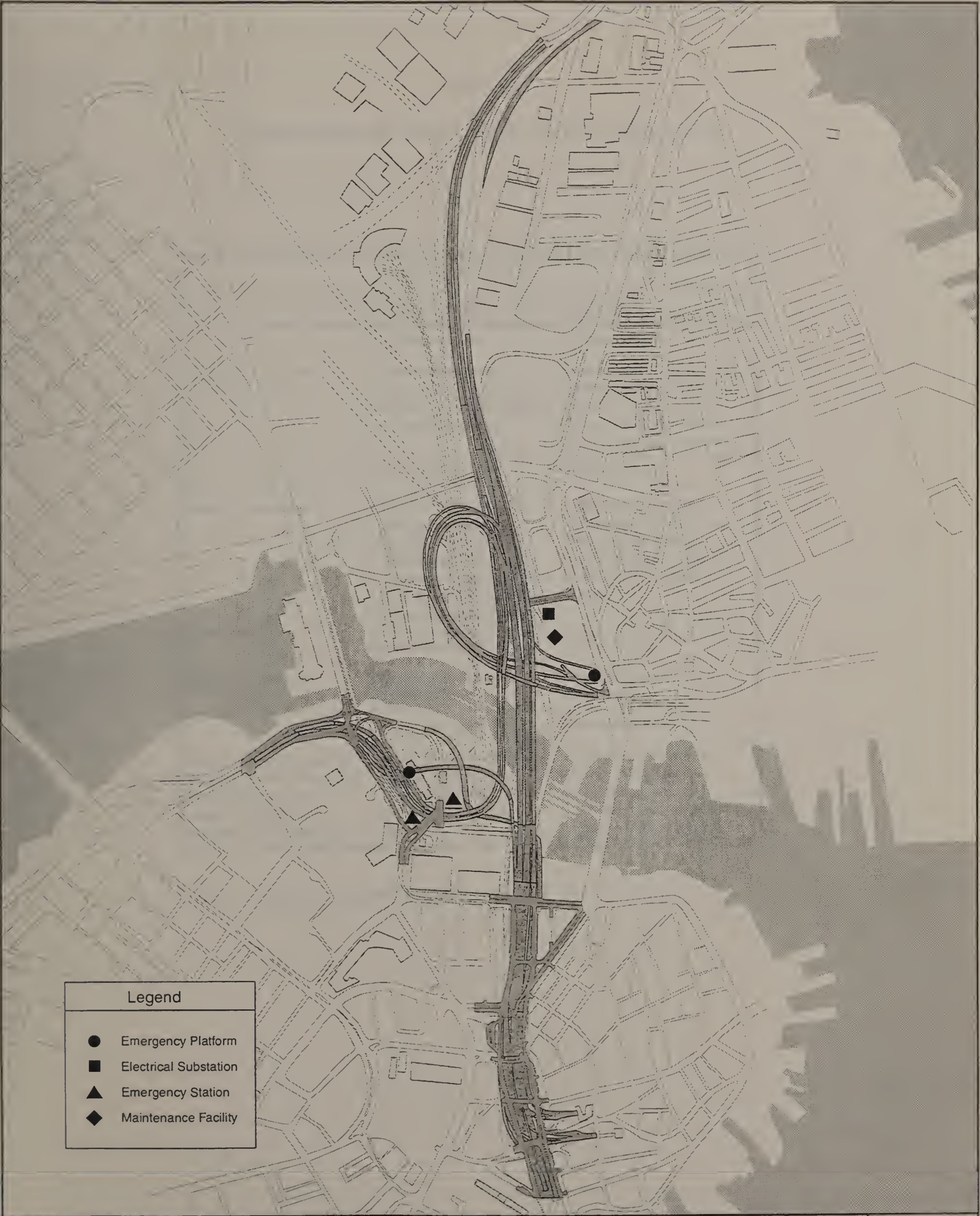

Legend
● Emergency Platform
■ Electrical Substation
▲ Emergency Station
◆ Maintenance Facility

FIGURE

4.42 Potential Locations of MHD Facilities

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET

Table 4.30

COMPARISON OF VISUAL IMPACTS BY ALTERNATIVE

	ALTERNATIVES	
	Preferred Alternative	**Scheme Z**
Bridges and viaducts	*Moderate Impact* Fourteen-lane bridge crossing. Two to three loop ramps. One four-lane viaduct at North Station area.	*Adverse Impact* Sixteen-lane bridge crossing. Complex multilevel loop ramps. Two-tier 6-lane viaducts at North Station area. Interruption of views.
Surface environment	*Moderate Impact* Proposed MDC parkland plane accommodated. Lomasney Way corridor adversely affected. One ventilation building on south bank mostly below ground with above-ground stacks.	*Adverse Impact* Major encroachment on riverbank and North Point. MDC parkland plan accommodated. Lomasney Way corridor adversely affected.
Tunnel environment	*Moderate Impact* Short land-based tunnel segments.	*Adverse Impact* Short underpass at Leverett Circle only.
Water environment (no. of piers in Charles River reflect existing shoreline; not sculpted shoreline in proposed MDC master plan)	*Moderate Impact* 6 piers in Charles River. 8 piers in Millers River. Moderate shadow impacts due to two separate bridge structures.	*Adverse Impact* 11 piers in Charles River. 8 piers in Millers River. Interruption of visual navigation. Major shadowing effects of bridge stucture.

Source: Bechtel/Parsons Brinckerhoff

stayed. MHD proposes a cable-stayed bridge. All surrounding historic monuments and church steeples are too distant to be adversely affected visually by the Project structure.

- Waterways: The waterways in this area include the Charles River and the Millers River.
- Parkland: The 1993 MDC master plan for the New Charles River Basin further details extensive proposed parkland and open space improvements along both banks of the Charles River which will be facilitated by the Project. The 1993 master plan describes recreational areas defined by a remodeled shoreline and new public attractions. The plan gives the area distinct appearances from the other adjacent parklands and from the surrounding residential, commercial, and institutional communities that are primarily urban development zones.
- Project-related buildings: The Project introduces a tunnel ventilation building, an electrical substation, and tunnel stairs enclosed in "headhouses." All the Project buildings are being located and designed to complement the desired future land uses. Three other MHD facilities are also located in the area: an emergency station, two emergency platforms, and a satellite maintenance facility. In addition, MHD is examining relocation options for the existing MDC central services facility located in the North Point area (see Figure 4.42).

4.9.2(a) Summary Of Visual Impacts By Alternative

The selection of the Preferred Alternative is based, in part, on consideration of the visual impacts of each of the four designs described in the 1993 DSEIS/R. The Preferred Alternative has the following visual impacts compared to Scheme Z.

View Of And From The Road.

Bridges And Viaducts: There are fewer and less complex bridges and viaducts in the Preferred Alternative than in Scheme Z. From a visual impacts standpoint, a cable-stayed bridge type is preferred for the mainline crossing. It provides the most transparent, yet impressive identification of the passage across the Charles River between Boston's downtown and the regional core districts; it provides for compatibility among highway structures; and it has the least impact of the three bridge types being considered on its immediate environment.

Surface Roads: The Preferred Alternative has surface roads which in most locations appear better than or equivalent to the surface roads of Scheme Z, particularly because of the land uses enabled by the surface road alignment (see Joint Development Impacts, 4.2.5, and Land Use, Social, and Farmland Impacts, 4.2.1). Viewed from the surroundings, the surface roads offer enhancement and definition of their surroundings: Nashua Street has the appearance of being the principal street of the North Station area; Leverett Circle has clear connections with the several roads that meet at this intersection; Nashua Street and Martha Road complement existing and desired future land uses.

The design of surface roads on the north bank in the Preferred Alternative is visually comparable to the design of Scheme Z. An improvement is made by the Preferred Alternative with the realignment of Ramp C-L to create a new intersection at Cambridge Street in Charlestown. The visual impacts of Ramp C-L when viewed from the BHCC playing fields are avoided in the Preferred Alternative.

Tunnels: Tunnel environments are not visually adverse per se; however, a broad view of one's surroundings is more desirable over the visually reduced environment of the tunnel. Since the length of tunnel in the Preferred Alternative is short, driver experiences in these tunnels are not expected to be adverse.

Waterways. The visual impacts to the water environment vary considerably between the Preferred Alternative and Scheme Z. The shadowing and the blocking of surrounding views of and from the waterways are substantially improved in the Preferred Alternative as compared to Scheme Z.

Parkland. The visual environment of the parkland in the Preferred Alternative is a substantial improvement over the parkland environment in Scheme Z. The Preferred Alternative causes less shadowing, obstructs fewer surrounding views, and encroaches less on recreational land uses in the parkland.

Project-Related Buildings. The location and design of Project-related buildings in all cases enhances and conforms with the surrounding visual environment. The visual impact of Project-related buildings in the Preferred

Alternative is therefore equivalent to the impacts in Scheme Z, with the exception of the ventilation building in the Preferred Alternative. Most of the building will be underground, with ventilation stacks extending above ground.

4.9.2(b) Preferred Alternative

The visual impacts of viaducts in the Preferred Alternative are lessened by the separation of the two bridges. This reduces shadows on the parkland, and visually separates the bridge from the Storrow Drive connector bridge as two structural systems allowing the mainline bridge to stand alone, relatively uncluttered. The parkland areas are enlivened by implementation of the mitigation program.

View Of And From The Road. The Preferred Alternative has 14 lanes of traffic on two parallel bridges crossing the Charles River. Total structure width is approximately 270 feet separated by a 100-foot gap between structures. North of the river, five lanes on three loop ramps carry traffic between City Square and I-93. Four lanes in two of the loop ramps (Ramps N-S and S-N) connect Storrow Drive to I-93 northbound and southbound.

It has one ten-lane long-span bridge and a second four-lane medium-span bridge that is supported by four piers in the water.

Viaducts: Views are possible along the Charles River, and northeast and northwest to Charlestown and Somerville. The Storrow Drive connector bridge, which is approximately 100 feet west of I-93 and similar in profile, is not as high as the two-tier Scheme Z viaducts. The elevated views for motorists from it are wide, with less interruption from other viaducts and viaduct structures than in Scheme Z. Viaduct underdecks are visible to motorists and to park users, and their design is visually consistent with the highway and the highway elements.

The Preferred Alternative has less than half the number of loop ramps of Scheme Z. The impact is greatly reduced by their lower height, simpler pier design, and overall coordination as concentric ramps at approximately the same profile. In addition, the loop ramps maintain a 120-foot setback from the Charles River. In the area adjacent to North Point they are not as complex as the multilevel ramps of Scheme Z. They are designed so as not to detract from the visual environment of North Point, the parkland, and views from surrounding neighborhoods.

When a cable-stayed bridge is used for the mainline crossing, motorists view their surroundings from I-93 between towers on the south and/or north of the riverbank, and through suspension cables. A strong sense of the entrance to and from Boston is clearly conveyed by the bridge. Viewed from the surroundings, the bridge achieves a balanced relation between the cables and the sloping deck. Views are characterized by vertical tower(s) and a comparatively slender deck, between which tension cables are anchored.

The visual compatibility of the long-span mainline with the four-lane medium span is achieved when the two bridges are physically and structurally distinct, allowing them a relatively uncluttered independence.

Surface Roads: In the Martha Road/Lomasney Way corridor, Martha Road retains its existing appearance. At Leverett Circle and Lomasney Way/Nashua Street, the corridor includes intersections of arterial roads and driveways in a more complex arrangement than in Scheme Z. Surface roads in this 210-foot corridor are improved in appearance by landscaping, providing both driver and pedestrian orientation.

Service roads connecting to Rutherford Avenue occur mostly in an existing industrial area. In order to reach BSG, they cross over and partially fill the Millers River. Through landscape design, they are substantially screened from Rutherford Avenue and the proposed park.

Tunnels: There are approximately 2,850 lf of land-based tunnels on the south bank of the Charles River. Three routes in addition to one existing route beneath Leverett Circle are all located in the passage to and from I-93 downtown and Storrow Drive. These tunnels separate at Ramp CN-L which climbs to intersect Nashua Street. Particular design attention is given to the placement and design of signs and highway elements to maximize views of the road ahead, and to coordinate with other tunnel elements.

Waterways. The shadowing and blocking of surrounding views of and from the waterways are substantially improved in the Preferred Alternative. This is largely due to two factors: the reduction in the number, height, and complexity of the loop ramp structures and their proximity to the north bank of the Charles River; and the approximately 100-foot gap that allows light to penetrate between the two bridge structures. These two distinct bridges make the visual impact on the water environment minor in comparison to Scheme Z.

Parkland. Viewed from the highway, only some sections of parkland under I-93 are momentarily hidden from view. No tunnel egress stair enclosures are located in the proposed parkland.

Pedestrians on the north bank capture views between the historic railroad Tower A and Paul Revere Landing Park North along the shoreline. This is separated into two visual zones by the overhead separation of mainline and supplemental bridges. The shadows of the viaduct are separated by sunlight through the gaps. Pedestrians on the south bank have uninterrupted passage under I-93. From the shoreline parkland views are combined with the architecture of the bridge abutment. As with the north bank, the south bank benefits from the separation.

Project-Related Buildings. This alternative has one ventilation building on the south bank. It is built below ground except for an air-intake structure, some smaller structures, and a frame that supports the air-exhaust discharge stacks. The ventilation building is surrounded by a joint development parcel (see Section 4.2, Joint Development Impacts). Only the tops of the stacks are visible after the surrounding buildings are developed. They cause only a minor addition to the skyline created by other structures at this height.

Three tunnel egress stair headhouses are required for the tunnels on the south bank. These are integrated with other proposed parkland uses. Above-ground structures are separated into smaller components as far as possible.

An electrical substation is located on the north bank behind a landscape buffer parcel on Rutherford Avenue. The building is approximately 20 feet high. It is not easily visible from Rutherford Avenue which is approximately 25 feet above the site of the substation, and the landscape buffer is designed to screen views of the building from Charlestown. The substation is visible from surrounding road south and west, but views of it from that direction are consistent with other adjacent views. The substation is not conspicuous from the mainline.

Two emergency response platforms (EP) are required in the area. These facilities have a structure of approximately 250 sf for two vehicle parking spaces each. The locations of the EPs have not been finalized; however, two sites are under consideration (see Figure 4.42). On the north bank, the EP could be located adjacent to the CANA ventilation building at Rutherford Avenue. On the south bank, the EP could be located behind the Registry building adjacent to the Lomasney Way corridor. In both cases, the EP is visually consistent with the appearance of its immediate surroundings, and discrete in and of itself.

An MHD emergency station (ES) is required in the area. The ES facility occupies approximately 0.5 acre and operates on a 24-hour basis. The location of the ES has not been finalized, although three locations are under consideration (see Figure 4.42): (1) adjacent to the substation on the Rutherford Avenue parcel; (2) in the proximity of the ventilation building on the south bank and constructed mostly below ground; and (3), at the northern end of the Lomasney Way parcel and constructed mostly below ground. At the Rutherford Avenue parcel, the visibility of the ES from Charlestown is partially screened by the buffer parcel. At both sites on the south bank, the ES is constructed below ground so that from a visual impacts standpoint it has minor consequences.

An MHD maintenance facility (MF) is located in the area. The MF occupies approximately 1.25 acres. Its purpose is to accommodate personnel and maintenance equipment for MHD highways and highway appurtenances in the area on the 24-hour basis. The location of the MF has not been finalized, although two locations are under consideration (see Section 4.2.1 and Figure 4.42): (1) adjacent to the substation on the Rutherford Avenue parcel; and (2), north of the Gilmore Bridge. At the Rutherford Avenue parcel, the MF is partially screened from Charlestown; at sites north of the Gilmore Bridge, the MF is not conspicuous among other similar land uses. MHD will continue to study potential alternative sites in an attempt to combine this facility with other similar transportation facilities in the area.

4.9.2(c) Scheme Z

Scheme Z creates a noticeable impact on the visual environment of motorists, pedestrians, and adjacent buildings. Three new bridges cross the Charles River, lower and wider than the existing bridge, and a vast multilevel ramp system impose on North Point and the north bank of the Charles River.

View Of And From The Road. Scheme Z includes 16 lanes of traffic crossing the Charles River on viaducts, 275 feet in width including gaps between them. Ten lanes in six loop ramps on the north bank of the Charles River are partially over the proposed North Point multiuse development site. Six lanes of traffic (CN-S and S-CS, the Storrow connector viaduct) connect Storrow Drive to I-93 northbound and southbound. The design has three bridges: two five- to six-lane long-span bridges and one six-lane double-deck medium-span bridge. The long-span bridge and the medium-span bridge have different profiles. There are 11 piers in the water and many on land, each having a diameter of approximately 8 feet. Added to these views is the traffic on the viaducts, which is visible from the affected environment.

Viaducts: The two-tier Storrow Drive connector viaduct and the six loop ramps vary in height between I-93 and City Square. From the surroundings they interrupt views of Bunker Hill, the new Boston Garden, the Charles River, and northeast and northwest to Charlestown and Somerville. The complexity of the mainline alignment and profile in this design affects the appearance of the bridge support structure.

On the I-93 northbound and southbound viaducts, drivers view an inclined road between Portal Park and the north bank. Drivers on the Storrow Drive connector bridge travel at approximately level gradient alongside I-93. I-93 slopes up toward the north, and descends in the loop ramps to City Square. As a result, drivers view their surroundings from points between 35 and 100 feet above water. Most views of their surroundings are experienced when travelling south toward Boston. Elevated views are possible, but numerous viaducts crossing overhead disrupt views. Consequently, drivers are sometimes in the shadow of other viaducts and piers.

The visual compatibility of Scheme Z's long-span and two-tiered medium-span bridge is difficult to achieve. No bridge types enable the medium-span bridge to be compatible with its context or with the mainline, nor to have its desired prominence within the city.

When a cable-stayed bridge is used for the mainline crossing, motorists view their surroundings from I-93 between staggered towers on the south and/or north banks of the river, and through the suspension cables. This bridge type is more visually prominent and impressive than the other bridge types, especially in relation to the loop ramps.

Surface Roads: Martha Road is a local traffic distributor to the Charles River Park apartment complex. The other adjacent surface streets provide connections to and from O'Brien Highway, Storrow Drive, and Causeway Street. The visual environment is complicated by the transition of the MBTA Green Line from tunnel to viaduct.

The service road from Rutherford Avenue which partially fills the Millers River to access BSG is screened from Charlestown and the north bank park by landscaping, and is adjacent to industrially zoned areas. Landscape design screens the transportation uses from the adjacent residential areas.

Tunnels: There are two short tunnels under Leverett Circle. One reuses the existing underpass; the other is new. Their visual impact is consistent with the overall appearance of the roads.

Waterways. In Scheme Z, I-93 passes a minimum of 23 feet over the Charles River at the recreational lock. The bridge is supported by 11 piers in the water that align with the north-south axis of the highway rather than with the direction of the river or the riverbanks.

Impacts on the view from the Charles River are similar to those described below as parkland impacts. Further, the location and orientation of piers in the water visually dominate the river, and create a 270-foot-long corridor of shadow, interspersed with three gaps totalling 65 feet. The piers interrupt the view to the water environment on the other side of the overhead highway. The bank is skewed to the bridge alignment, reducing the width of the water sheet at this location.

Parkland. In Scheme Z, the parkland is narrowed along the river and partly in shadow, due to the loop ramps. The granite seawall would be restored at the west edge of North Point, the south bank adjacent to the bridge pier, and the north bank would be west of the bridge pier. The proposed parkland is complementary to several surrounding new buildings, and would be connected across the Charles River by a pedestrian bridge alongside the MBTA railroad bridge.

Pedestrians on the south bank have access under the I-93 viaducts alongside the Charles River, with approximately 10 feet of overhead clearance. Pedestrians on the north bank have ample riverfront views under the I-93 viaducts, although in a shadowed area.

Project-Related Buildings. No ventilation buildings are required. No tunnel egress stair headhouses are required. Ancillary buildings were not sited for Scheme Z.

4.9.3 Mitigation And Enhancement Measures

In order to mitigate negative and to maximize positive visual impacts, efforts will be made to integrate the following measures into the Preferred Alternative:

- Provide for compatibility of all elements of the highway with the proposed parkland, with the objective of fostering recreational uses and minimizing acoustic and shadow impacts of the highway.

- Provide for compatibility between Project-related buildings and necessary surface roads and open space to provide a visually cohesive urban environment.

- Design and locate Project-related buildings in a practical yet visually sensitive manner that is compatible with surrounding neighborhood activity to the maximum extent possible.

- Integrate public art with the Project structures, buildings, and parkland through the Artery Arts Program to enhance Project elements and make viable community spaces.

- Design compatible high-quality bridges that are in keeping with their prominent locations, framing entrances to and from Boston and the Charles River Basin. Make certain that the bridge design provides an acceptable balance of safety, economy, constructibility, and aesthetics.

- Design landscape and architectural elements in a broad urban framework to screen undesirable views, to provide a coherent visual environment, and to make visual connections with the surroundings.

4.10 ENERGY

4.10.1 Introduction

This section quantifies the direct and indirect energy expenditures associated with the Preferred Alternative and Scheme Z. Direct energy involves all energy consumed by vehicle propulsion and the amount of electricity used for tunnel ventilation and lighting. Indirect consumption involves the one-time expenditure of energy required for constructing the Project. This analysis estimates projected energy consumption in the year 2010 for the two designs.

This analysis estimates projected energy consumption in the year 2010 for the Preferred Alternative, and then compares those figures with anticipated consumption levels for Scheme Z.

4.10.2 Impacts

4.10.2(a) Direct Energy Analysis

Fuel Consumption. Fuel consumption by vehicle is calculated based on Project traffic data on VMT and average travel speeds, together with speed-sensitive fuel consumption formulas presented in FHWA-TSA-81-210, *A Method For Estimating Fuel Consumption and Vehicle Emission On Urban Arterials And Networks*. The fuel consumption by vehicles was the average calculated based upon local streets, highways and ramps, and covered highways.

Table 4.31 provides estimates of total VMT and annual fuel consumption for the Preferred Alternative and Scheme Z, as well as energy expenditures to maintain electrical systems. Because of its higher VMT and lower network speeds, fuel consumption is higher under Scheme Z at 11.62×10^{12} British thermal units (Btu). Fuel consumption under the Preferred Alternative is projected to be slightly lower at 11.57×10^{12} Btus. Both alternatives would result in savings in vehicular fuel consumption when compared to the no-build scenario. The 1991 Projectwide FSEIS/R estimated that Scheme Z would result in an annual savings of 128,900 equivalent barrels of oil compared to the no-build scenario.

Electrical Consumption. Annual electrical energy consumption requirements for tunnel ventilation, drainage, and roadway lighting in the Area North of Causeway Street has been estimated by Project electrical engineering staff and is summarized in Table 4.31. Scheme Z has the lower annual energy requirement for electrical systems (11,950 Btus) because it involves the shortest distance of roadway in tunnel. The Preferred Alternative will require 28,330 million Btus.

Total Direct Energy Consumption. Total annual direct energy requirements are projected to be highest under Scheme Z at 2,794,186 equivalent barrels of oil. The Preferred Alternative will consume 2,772,614 equivalent barrels of oil and would result in a 0.78 percent savings.

4.10.2(b) Indirect Energy Analysis: Construction Energy

The analysis of construction energy quantifies and compares the amount of energy required to construct all Project infrastructure in the Area North of Causeway Street under both designs. For the purpose of this analysis, the length of all new structures associated with the two designs has been divided into the total number of lane-miles constructed at grade, on elevated structures, in boat section, or in tunnel. Construction energy requirements are then derived by multiplying these lengths by Btu per-lane-mile figure, which quantify the amount of energy necessary for these various types of construction. The construction energy requirements for the two designs are summarized in Table 4.32. Although Scheme Z has a shorter lane-mile total in the Area North of Causeway Street, it has a higher construction energy requirement at 332,860 equivalent barrels of oil. The high construction energy requirement for Scheme Z is due to the large amount of energy-intensive elevated roadway construction. The construction energy requirement for the Preferred Alternative is expected to be 326,980 equivalent barrels of oil, or an energy savings of 1.78 percent from Scheme Z.

4.10.3 Conclusion

The energy analysis has demonstrated that Scheme Z has both the higher direct and indirect energy requirements. As a result, implementation of the Preferred Alternative would result in energy savings. The 1991 FSEIS/R concluded that the direct energy savings realized under Scheme Z, when compared to a future no-build scenario, would compensate for construction energy requirements in approximately 7 years. Implementation of the Preferred Alternative would result in a slightly shorter payback period.

4.11 RELATIONSHIP OF LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

This chapter discusses in general terms the relationship of local short-term impacts and the use of resources and long-term productivity for the Preferred Alternative compared to Scheme Z.

4.11.1 Short-Term Uses And Long-Term Productivity

Both designs are based on State and local comprehensive planning to meet current and future traffic requirements of the Central Artery/Tunnel Project in the Area North of Causeway Street. They are designed within the context of present and future land use development in the area. Therefore, the short-term use of resources required to implement these designs is consistent with the maintenance and enhancement of the long-term productivity of the subarea.

4.11.1(a) Preferred Alternative

The estimated construction period for the Preferred Alternative is 8.5 years. Construction is planned to minimize impacts on the environment by maintaining traffic operations. Traffic detour management provides for uninterrupted vehicular traffic flow during construction.

Existing public parking spaces that are displaced due to construction are replaced at new sites. Potential neighborhood impacts are mitigated by measures identified in construction contract specifications. Noise and vibration impacts of the construction activities are reduced by requiring that construction activities and equipment meet local and Federal noise regulations.

Air quality effects during construction caused by detouring of traffic and by the construction activities are minimized by the scheduling of construction activities, by imposing maintenance programs for construction equipment, and by modifying existing traffic controls and traffic signal timing where appropriate. These measures will be specified in detail based on consultation with local and State agencies during completion of the final design of the Preferred Alternative.

This design results in substantial improvements to transportation services and in potential increases in development opportunities within the regional transportation network. The cumulative long-term benefits are beneficial to the regional environment and far outweigh the short-term adverse impacts.

4.11.1(b) Scheme Z

The construction duration for Scheme Z is estimated at

Table 4.31

ANNUAL DIRECT ENERGY CONSUMPTION
Year 2010

Energy Consumer	Preferred Alternative	Scheme Z
Motor Vehicles		
Annual vehicle miles travelled	1,802,669,030	1,812,740,725
Gallons consumed:		
Gasoline	78,502,900	78,856,300
Diesel	9,932,400	9,984,300
Total	88,435,300	88,840,600
Btus consumed (millions)	11,566,100	11,619,200
Electrical Systems (for ANOCS only)		
Btus consumed (millions)	28,330	11,950
Total Direct Energy Consumption		
Btus consumed (millions)	11,594,500	11,631,100
Bbls consumed	1,974,000	2,003,144

1 gallon gasoline = 130,000 Btus
1 gallon diesel fuel = 137,000 Btus
1 barrel crude oil = 5,900,000 Btus (average for all crudes)
1 kilowatt-hour = 3,413 Btus

Fuel Consumption Standards: Federal Highway Administration
Conversion Sources: Department of Energy and Environmental Protection Agency

Note: One British thermal unit (Btu) is the quantity of energy necessary to raise one pound of water one degree Fahrenheit.

Source: Bechtel/Parsons Brinckerhoff

Table 4.32

CONSTRUCTION ENERGY REQUIREMENTS

Design	Lane-Miles In ANOCS	Btus Consumed (billions)	Bbl Consumed
Preferred Alternative	19.06	1,897	326,980
Scheme Z	16.35	1,930	332,860

Source: Bechtel/Parsons Brinckerhoff

8.5 years. Construction of Scheme Z is planned to minimize impacts on the environment by maintaining traffic operations on existing portions of the highway. Traffic detour management will provide for uninterrupted vehicular traffic flow during construction. Scheme Z has minimal impact to navigation in Charles River.

The short-term uses of the environment are expected to be similar to the Preferred Alternative, with minimal impact to navigation in the Charles River.

In the long term, Scheme Z results in improvements to transportation services and potential increases in development opportunities in the Area North of Causeway Street. Scheme Z also reduces traffic levels on existing streets in central Boston, Charlestown, and Cambridge. The cumulative mass of bridge and ramp structures has a major visual impact in this area, slightly reduced by removal of the existing I-93 viaduct.

4.11.2 Summary

Construction of either design includes measures to mitigate potential short- and long-term adverse impacts. With the above general commitments, the short-term construction period impacts are minimized while enhancing the long-term productivity of the environment. Moreover, the cumulative impacts of the Project outlined in Section 4.12 are considered beneficial to the regional environment, and far outweigh local adverse impacts. This conclusion is the same as for the entire Central Artery/Tunnel Project, as stated in the 1991 FSEIS/R.

4.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of the Preferred Alternative or Scheme Z involves the permanent commitment of resources. This section discusses the natural, physical, and fiscal resources that are committed in the Area North of Causeway Street, and the relationship of the Project to other projects, existing or planned, in the subarea. The resources expended for the Project as a whole, and its relationship to projects in other subareas, are detailed in the 1991 FSEIS/R and are not repeated here.

4.12.1 Commitment Of Resources

The resources are being committed to the Project in the Area North of Causeway Street so that the Central Artery/Tunnel Project can be completed to improve the quality of the regional transportation system. Benefits will consist of improved accessibility, savings in travel time, and greater availability of quality services which outweigh the commitment of these resources.

Onetime Expenditure. Construction and right-of-way acquisition for either design will require a substantial expenditure of State and Federal funds which are not retrievable. Construction of either design will add to the estimated amount. These estimated costs, in August 1993 dollars, are as follows:

Preferred Alternative	$ 995 million
Scheme Z	$ 489 million

Raw Materials. Considerable amounts of labor, fossil fuels, Btus, and highway construction materials such as cement, aggregate, bituminous material, and steel will be expended in constructing either design. In addition, large amounts of labor and natural resources are used in the fabrication and preparation of the designs. The total energy expenditures in the construction of the designs are not retrievable.

Land/Building Acquisition. The permanent acquisition of land is required for the Charles River crossing. The following figures are approximate acreages:

Preferred Alternative	29 acres
Scheme Z	18 acres

The above acreages do not include Boston and Cambridge city streets or MHD-owned property. In addition, under the Preferred Alternative, the Anelex building and the Boston Thermal Energy Corporation's Minot Station are displaced. The Spaulding Rehabilitation Hospital will be taken and demolished with the Preferred Alternative, and not with Scheme Z.

Air Rights. The development of air rights above the Project right-of-way is not precluded. The Preferred Alternative affects development of the air rights garage planned by the MBTA over the railroad tracks north of the new Boston Garden development.

Wetlands. In both designs, removal of the present I-93 piers (except the banana pier) enhances the Charles River. The Preferred Alternative displaces 1.1 acres of the Millers River, to allow a greater setback for loop ramps from the Charles River.

Parklands. The open space available for proposed parkland on both banks of the Charles River is expanded under the Preferred Alternative. Expansion of the south bank corridor from the Esplanade to the Harbor is made possible. There is some encroachment on the area by the structures of Scheme Z.

Shadows. Shadow impacts are greater under Scheme Z than under the Preferred Alternative; the latter has narrower bridges with consistent profiles and fewer loop ramps. Shadows from existing highway structure are eliminated with Scheme Z or with the Preferred Alternative. The benefit to the City of Boston remains as stated in the 1991 FSEIS/R: the Project reverses the prior commitment of such resources by the existing elevated Central Artery.

4.12.2 Relationship To Other Projects

Several projects in the Area North of Causeway Street by other proponents are underway or are planned for construction concurrent with the Project. Construction must be coordinated to avoid conflicts and to avoid disruption of businesses and of vehicular and pedestrian traffic. In some cases, as with the CANA project, a tie-in with Project components is necessary. Cooperation among all agencies and private developers, and coordination of schedules and planning details will contribute to an orderly progression of all undertakings.

CANA. CANA project ramps provide connections between I-93 and Route 1.

MBTA.

Underground Parking Garage: Since the 1990 publication of the FSEIS/R, construction has been initiated on a 1,300-space underground parking garage behind the Boston Garden.

North Station Transportation Improvement Plan: Commuter railroad service is to be upgraded:

- extension of the 10 railroad tracks and high-level platforms 275 feet south toward the north facade of the existing Boston Garden
- construction of a new Green/Orange Line superstation below grade at North Station
- replacement of the Green Line now on viaduct on Causeway Street with a new below-grade alignment behind Boston Garden and through the edge of the 1,300-space garage mentioned above

Also included are the foundation supports for development of a future air rights parking garage over the railroad tracks.

Stations: A new and relocated Lechmere station is planned in East Cambridge. Science Park station is affected by the Project and will be reconstructed by the MBTA in coordination with MHD.

North/South Station Rail Link: The feasibility of a rail link between North and South Stations is being studied separately by the Massachusetts EOTC and the FTA. Alternative alignments take the new underground Artery into consideration. Neither the Preferred Alternative nor Scheme Z precludes this rail link, since there are no river tunnels to encumber the rail link construction.

Private Developments.

New Boston Garden Corporation: Since the 1991 FSEIS/R, construction has begun on a 19,500-seat sports arena in air rights above the MBTA garage. In addition, a future commercial complex will encompass the site of the existing Boston Garden and adjacent areas north of Causeway Street, and will include office and retail uses. However, such commercial development has been postponed, awaiting stronger market conditions.

Massachusetts General Hospital: A garage/office building is planned to be built over a parcel of land along the east side of Nashua Street between the Spaulding Rehabilitation Hospital and North Station.

West End: The last parcel of the West End Urban Renewal Area adjacent to Charles River Park will be developed by Lowell Square Associates. The project includes cooperative apartments, elderly housing, a visitors center, underground parking, and commercial space.

North Point, East Cambridge: Multiple unit housing is planned by private developers for the area bounded by the Gilmore Bridge, commuter railroad tracks, and the Charles River. This development program is consistent with Cambridge City planning and MDC park planning.

ENDNOTES FOR SECTION 4.5 AQUATIC RESOURCES

[1] Elevation 103.5 was established as the Mean Annual Flood Level based on information found in the FEMA report and published information found on the design criteria established for the Charles River Dam which defines the normal basin elevation at 3.3 feet (NGVD) and indicates that flooding occurs when the basin elevation is increased by 2 inches over the normal elevation or 3.5 feet.

[2] Harbor Tunnel, Fort Point Channel, and Charles/Millers Rivers

[3] MEPA Certificate of 1993 DSEIS/R, p. 14, first paragraph

[4] The determination that "nonwater-dependent" facilities which share a use with "water-dependent" facilities are therefore "water-dependent" is recognized in Section 9.12(3) of the regulations under the definition of accessory to a water-dependent uses. This section allows uses to be defined as water-dependent accessory uses when it is found that said use is customarily associated with and necessary to accommodate a principal water-dependent use. Examples which are provided in the regulation includes uses which may typically be viewed as nonwater-dependent such as "access and interior roadways, parking facilities, administrative offices, and other offices primarily providing services to water-dependent use on the site, ...restaurant and retail facilities etc."

[5] I-93 piers to be removed occupy approximately 1,000 sf of LUW.

[6] For waterways purposes, the entire footprint of the trestle deck was quantified.

[7] MEPA Certificate of 1993 DSEIS/R, p. 14, first paragraph

[8] The determination that "nonwater-dependent" facilities which share a use with "water-dependent" facilities are therefore "water-dependent" is recognized in Section 9.12(3) of the regulations under the definition of accessory to a water-dependent uses. This section allows uses to be defined as water-dependent accessory uses when it is found that said use is customarily associated with and necessary to accommodate a principal water-dependent use. Examples which are provided in the regulation includes uses which may typically be viewed as nonwater-dependent such as "access and interior roadways, parking facilities, administrative offices, and other offices primarily providing services to water-dependent use on the site, ...restaurant and retail facilities etc."

[9] Total overhead structure within a 40-foot corridor along both banks of the Charles River for both designs was determined. It was assumed that the entire 2,200 lf of Millers River bank would be affected. Scheme Z places a total of 1,175 feet along the Charles River and removes 65 lf of the existing I-93 structure for a net impact of 1,110 lf. The Preferred Alternative places 750 lf within this corridor on the Charles River, less 65 lf of I-93 for a total impact of 585 lf on the Charles River.

[10] [ref.: CDM Final Sampling and Analysis Summary Memorandum, Charles River Crossing Alternatives, Design Package DO19A, February 1993]

5. Construction Impacts

Chapter 5
CONSTRUCTION IMPACTS

This chapter presents a conceptual description of construction activities and duration for the Preferred Alternative. Comparisons to the 1991 Proposed Action (Scheme Z) are identified if there are substantial differences. The discussion is based upon a conceptual design as is customary for this stage of the environmental process. The chapter briefly discusses the construction staging sequences, and the temporary mitigation measures required during construction.

The construction of the Preferred Alternative is substantially similar to Scheme Z. There are, however, two distinct differences. North of the Charles River, construction is easier because the structures are more compact and fewer ramps are involved. In the North Station/Nashua Street area, however, the work is considerably more complicated for the Preferred Alternative. Here, a single viaduct (with Scheme Z) has been replaced with a viaduct plus several tunnels crossing under the MBTA commuter railroad tracks and platforms, requiring more earth support systems and underpinning.

During the construction period of the Project in the Area North of Causeway Street, some disruptions to abutting activities will occur. For this reason, preliminary construction staging plans have been developed for this environmental study to safely and efficiently maintain traffic and to minimize adverse impacts of construction activities on individuals, material resources, business operations, and structures within the Project area. Nonetheless, construction on the scale of this Project involves some interference to the environment, facilities, and patterns of activity for an extended period of time. Bridge construction in the Charles River requires turbidity controls and temporarily affects navigation. Construction also causes increased impacts to the wetlands resources of both the Charles and Millers Rivers.

5.1 CONSTRUCTION PLAN

The construction plan in the Area North of Causeway Street is described in several sections to facilitate understanding of the construction activities, the existing conditions, and traffic maintenance. The bridges and land-based tunnels are complex structures which require a substantially long time for construction. There are several methods by which these structures may be built, and these methods will be detailed during the subsequent preliminary and final design phases. Typically, selection of structure type and materials occurs at a later stage in design development than at the environmental review phase. Due to the constrained corridor and competing interests in this area, active coordination with regulatory agencies and affected communities has occurred to identify potential construction conflicts to navigation, traffic movement, fisheries, parkland, historic resources, and the visual setting. Accordingly, preliminary assumptions about the type of bridge structure, and construction methodology, and construction of the river bridges and land-based tunnels have been made and are described in Sections 5.1.1 through 5.1.8.

The Preferred Alternative is designed to move traffic through a complicated interchange linking major highways including I-93, Route 1, Storrow Drive, and key arterial streets. These highways carry a substantial volume of traffic, which impedes construction activities in the Area North of Causeway Street. Railroad transportation facilities, active institutional and commercial operations, and navigation in the Charles River further constrain construction in this area. The construction requires some degree of underpinning of adjacent structures, modifications to existing bridge and viaduct structures, construction of temporary roadway structures, and provision of staged detours, as well as construction near active commuter railroad areas, near major underground utilities, in and near the Charles and Millers Rivers, and in areas with difficult access. Section 5.1.4 discusses construction staging in order to compare the temporary impacts.

5.1.1 Charles River Bridges Construction Methods

MHD is committed to the long-span cable-stayed bridge type proposed for the Preferred Alternative as shown in Figure 2.6. Major components of this bridge include a three-span structure with two twin-legged towers using two planes of cable stays in the main span and a single plane in the back span. The design of the structure, the geometrics of the crossing, and other limitations or restrictions constrain the available construction methods. In addition, maintenance of navigation in the

Charles River is necessary, as is maintenance of vehicular traffic on all major interchange links, and these constraints are reflected in the selected construction method.

The depth of the main bridge superstructure, to accommodate an approximately 700-foot-long span, does not allow typical construction. It requires the superstructure for the main span to be made of a framed system consisting of structural steel or concrete. The main span is erected incrementally, progressing from the towers. As each segment of the structure is erected it initially cantilevers from the previous segment. Cable stays are installed following the erection of each segment. They are installed in the main span and back span at approximately the same time so that the load transferred to the towers is balanced by the two cantilevers. The design of the three-span structure requires that the back spans be cast-in-place on temporary structures referred to as "falsework," and anchored by additional ballast or tie-downs. One construction method considered feasible for the spans uses stiff-leg derricks mounted on the cantilever edge to set the structural steel framing in increments. The structural steel is lifted off barges below the structure or fed to the derricks with tower cranes erected on land alongside the piers.

The derricks, structural steel, cable stays, and other material or equipment are placed on the structure using the tower cranes. The structural steel is transported to the derricks across the structure and then erected. The three-span structure requires construction of the back spans prior to the main span. The main span is constructed in segments advancing from both towers toward the center span.

The Storrow Drive connector bridge adjacent to the mainline cable-stayed bridge will require the construction of two bents in the Charles River. These bents will be located behind the fender lines. Standard construction methods will be employed in this bridge's construction.

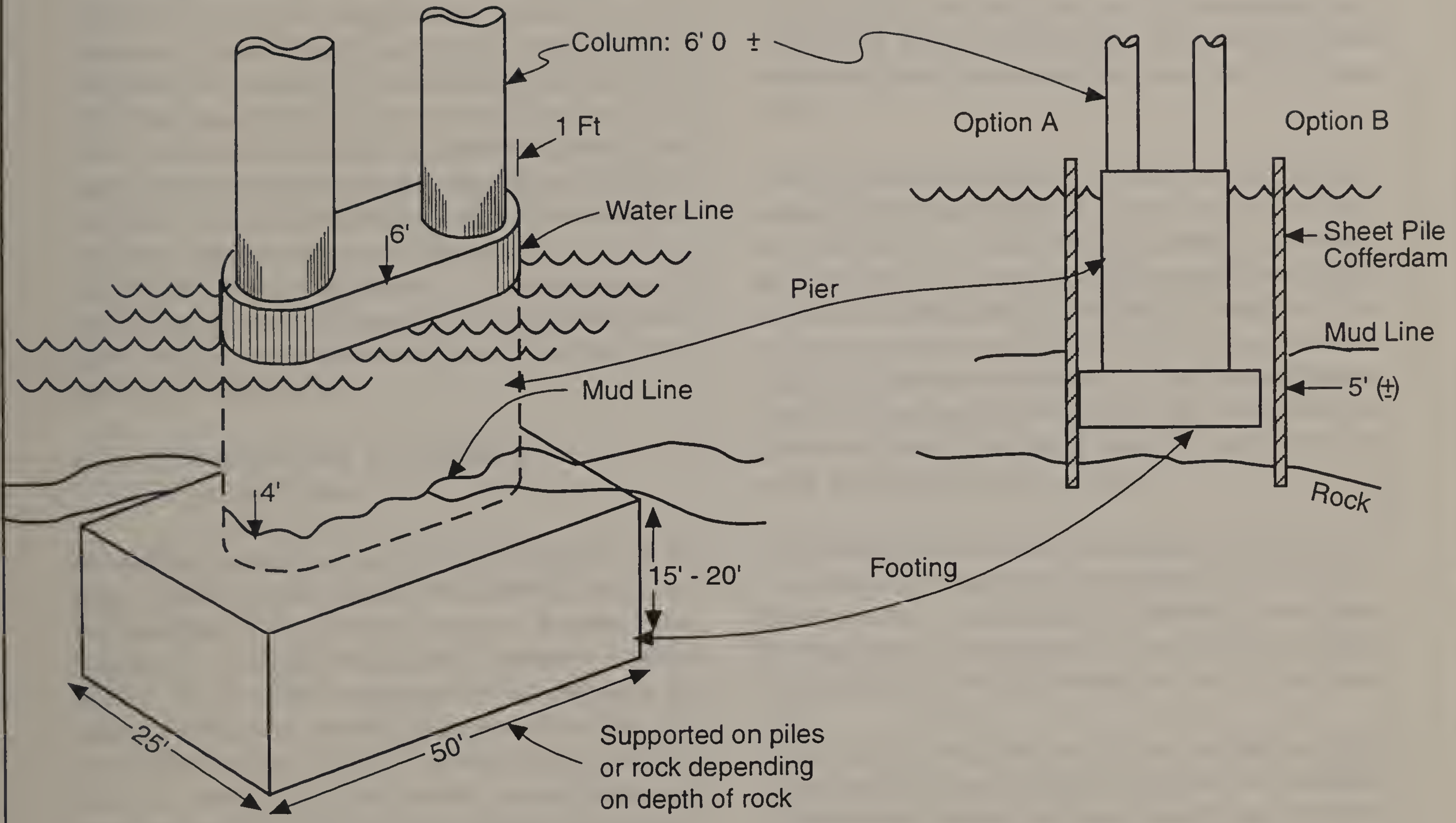
Bridge pier foundations located in the Charles River are constructed using cofferdams made of steel sheet piling. The sheet piling projects from above the high water level to below the bridge foundation or to bedrock, if the foundation bears on bedrock. The sheet piling is driven or vibrated into place using impact or vibratory hammers. Cranes, either waterborne or land based, are required for this operation. The internally braced sheet pile cofferdams are excavated with a clamshell to foundation elevation. A concrete seal is then placed underwater in the cofferdam. Once the seal has cured adequately the cofferdam is dewatered and pier construction proceeds in the dry. After construction of the pier, the steel sheet piling is cut off at the mudline or extracted. This is typically the construction contractor's option unless conditions require the piling to remain in place to enhance the stability of the foundation (see Figure 5.1 for conceptual pier configurations).

5.1.2 Construction Of Land-Based Tunnels

The Preferred Alternative includes land-based tunnels. The proposed construction method for the land-based tunnels is cut-and-cover. This general construction method was described in the 1991 Projectwide FSEIS/R. Excavation support systems are used for tunnel sections which are south of the Charles River. The support systems are either reinforced slurry walls, steel sheet piling, or soldier piles and lagging. Soldier piles and lagging are not used for deep excavations where groundwater is high. Alternate support systems to sheet piling will be evaluated for use in areas where Project-generated vibrations must be minimized.

Tunnel construction of Ramp L-CS requires underpinning the Registry building. The underpinning procedure involves installing additional supports to bearing below the tunnel subgrade. The tunnel is constructed with the supports projecting through the tunnel box. The supports are then transferred to the tunnel roof, which is designed to support these loads.

Construction Of Tunnel Sections In The Railroad Yard. The Project requires construction of tunnel sections for Ramps L-CS and CN-S in the MBTA railroad yard behind North Station. The MBTA requires a minimum of eight tracks at North Station to be maintained for adequate commuter rail service. The new six-level parking garage under the new Boston Garden, both under construction, will accommodate the extension of 12 railroad tracks. Presently North Station is serviced by 10 tracks with high-level platforms between them. The two tunnels are constructed concurrently in stages under the platform area. First, tunnel sections are built from the west to a point under Tracks 9 and 10 which have been taken out of service. Then, the new platform and Tracks 11 and 12 are constructed on land currently occupied by the Spaulding Rehabilitation Hospital. Tracks


Column: 6' 0 ±
1 Ft
Water Line
6'
Pier
Mud Line
4'
15' - 20'
Footing
25'
50'
Supported on piles or rock depending on depth of rock
Option A
Option B
Sheet Pile Cofferdam
Mud Line
5' (±)
Rock

Pier

(Typical for Storrow Ramps - Adjacent to Navigation Channel in Charles River)

Typical Cofferdam Treatment

A: Place foundation concrete against sheets. Pull sheets or, more likely, cut off at mud line.

B: Space left to form foundation. Pull sheets.

FIGURE

5.1

Conceptual Pier Configuration for the Storrow Drive Connector Bridge

Charles River Crossing FSEIS/R

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9, 10, 11, and 12 are placed in service. Construction of the remaining tunnel sections progresses across the railroad tracks in several stages, taking four tracks out of service at a time. Construction of the tunnel is by the cut-and-cover method, by underpinning the tracks, or by a combination of the two construction methods. The MBTA has installed caissons to support future air rights development above the railroad tracks in the North Station area. Caissons in conflict with the proposed tunnels are removed and replaced outside the limits of the tunnels as the work progresses. The construction of the viaduct foundations across the North Station commuter railroad area is performed at the same time as the tunnels are constructed.

5.1.3 Underpinning The Existing Central Artery

Among the construction issues to be addressed are the many columns which support the existing Central Artery mainline and connecting ramps to Storrow Drive which are in conflict with the new I-93 tunnel as it passes below. This conflict is eliminated by underpinning the existing structures, extending supports beyond the limits of the travelway below. There is insufficient clearance between the I-93 tunnel and the lowest northbound ramp to North Station. Prior to opening I-93 northbound, the ramp must be closed for the duration required to demolish it. Traffic will be detoured to local streets during this short period.

5.1.4 Construction Staging

Construction staging plans for both the Preferred Alternative and Scheme Z are provided here for comparison purposes. Both designs require the same construction duration, 8.5 years.

5.1.4(a) Preferred Alternative

Preliminary construction staging plans have been developed for the entire Area North of Causeway Street. Construction in the area will be accomplished through several contracts; three major ones for Project structures, and others for utility relocation, the ventilation building, demolition, landscaping, and restoration. Each of these contracts will have major milestones to be achieved so that each of the new ramp and lane openings proceeds on a coordinated basis. The need to maintain traffic is a major factor in developing the construction staging and the overall duration. A maintenance of traffic plan summary appears in Section 5.1.5. Complete staging and traffic maintenance plans will be developed during final design and will be coordinated with the cities of Boston, Cambridge, and Somerville, and with the regulatory agencies having jurisdiction over these issues.

Prior to the commencement of construction, the temporary CANA loop ramps, currently under construction, will have been completed and opened. The temporary T-C and C-T ramps provide connections between the Route 1 tunnels and the existing I-93 mainline. The existing connections to Route 1 will have been removed. Below is a summary description of traffic maintenance plans and construction staging in the Area North of Causeway Street. Each stage generally is delineated by major traffic maintenance changes.

The construction stages are developed to support an I-93 northbound opening and, subsequently, an I-93 southbound opening. Some early tunnel openings relieve traffic demands on connections to Leverett Circle which will facilitate follow-on construction work in this area.

Stage 1. This stage begins with the demolition of the Minot Station steam generating plant and the Spaulding Rehabilitation Hospital, and relocation of major utilities, especially in Leverett Circle, the North Station area, and the CANA loop ramp area (see Figure 5.2). Leverett Circle and adjacent streets are temporarily widened to mitigate construction impacts on traffic flow.

Work is begun on the I-93 mainline bridge and the adjacent Storrow Drive connector bridge (Ramp S-N). The new mainline is constructed to the northern limit where it and the existing mainline converge and the structures conflict.

On the north side of the Charles River, the collector/distributor roadways (Ramps N-S, N-T, T-N, S-N) are constructed to completion or to the point that conflicts with existing structures. Ramps C-T, T-C, and S-T are constructed to where they conflict with the existing CANA loop ramps.

South of the Charles River, tunnel portions (Ramps CN-S, L-CS, and CN-L) are built from the Leverett Circle area east under the North Station commuter railroad tracks. The ventilation building is constructed during this phase, and as much of the new loop ramps (C-T and T-C) as possible.

Finally, temporary ramps connecting the newly built collector/distributor roadway to the existing I-93 viaduct are constructed as well as portions of Leverett Circle and Nashua Street.

Stage 2. In this phase the focus shifts from construction in those areas that do not affect the existing structures to the use of several temporary ramps (see Figure 5.3). Several existing highway structures are demolished to make way for the new roadways.

Traffic is routed over the newly constructed temporary ramps from the new collector/distributor (Ramps N-S and S-N) to the existing I-93 viaduct. Traffic is also rerouted from I-93 northbound over the partially built C-T. Temporary C-T is then partially demolished and the rest of the new C-T is constructed as well as the new I-93 northbound previously in conflict.

On the south side of the Charles, the I-93/Storrow Drive viaduct at North Station is underpinned. Temporary on/off-ramps from the Storrow/Leverett terminus are constructed. Ramps CN-S, L-N and S-N are then completed.

Stage 3. The last major segments of the northern portion of I-93 mainline are built in this stage (see Figure 5.4). First, a temporary ramp is constructed from the new C-T to the temporary CANA Ramp T-C. At this point the northernmost 1,000 feet of the existing mainline I-93 is demolished where it conflicts with the new structures. The new I-93 mainline is then constructed.

I-93 northbound is opened to traffic. Ramp C-T is operated in the southbound direction and the existing temporary CANA Ramp T-C is demolished. The new I-93 southbound previously in conflict is then completed and the newly aligned Ramp T-C is constructed. This stage ends with the opening of I-93 southbound to traffic.

Stage 4. The existing mainline bridge over the Charles River and the viaduct on the north side of the river can now be demolished (see Figure 5.5). Ramp SA-CN is constructed and permanently tied into the new I-93 northbound. Ramp T-C is opened to traffic, completing the major work north of the Charles River. South of the Charles, the Leverett/Storrow on/off viaduct is demolished. Ramp N-S is completed. Finally, all temporary ramps are removed.

5.1.4(b) Scheme Z

Scheme Z entails construction of the mainline and ramp viaduct structures, bent modifications to the existing mainline and viaduct roadways. Bridges and viaducts are the primary types of structures; there are no tunnels. Some tunnel transition and at-grade section construction is required. Standard techniques are used.

Stage 1. The MBTA Science Park station at Leverett Circle is underpinned, coordinating with the MBTA's Green Line project. Construction of the river Crossing is phased so that new connections to Leverett Circle and Storrow Drive are operational before the opening of the new mainline roadways. A temporary viaduct structure is constructed across the North Station railroad track area. Ramp viaducts completed include S-N and CN-S (partially), N-S, N-T, T-S, and S-CS. Remaining loop Ramps S-T and L-T are completed.

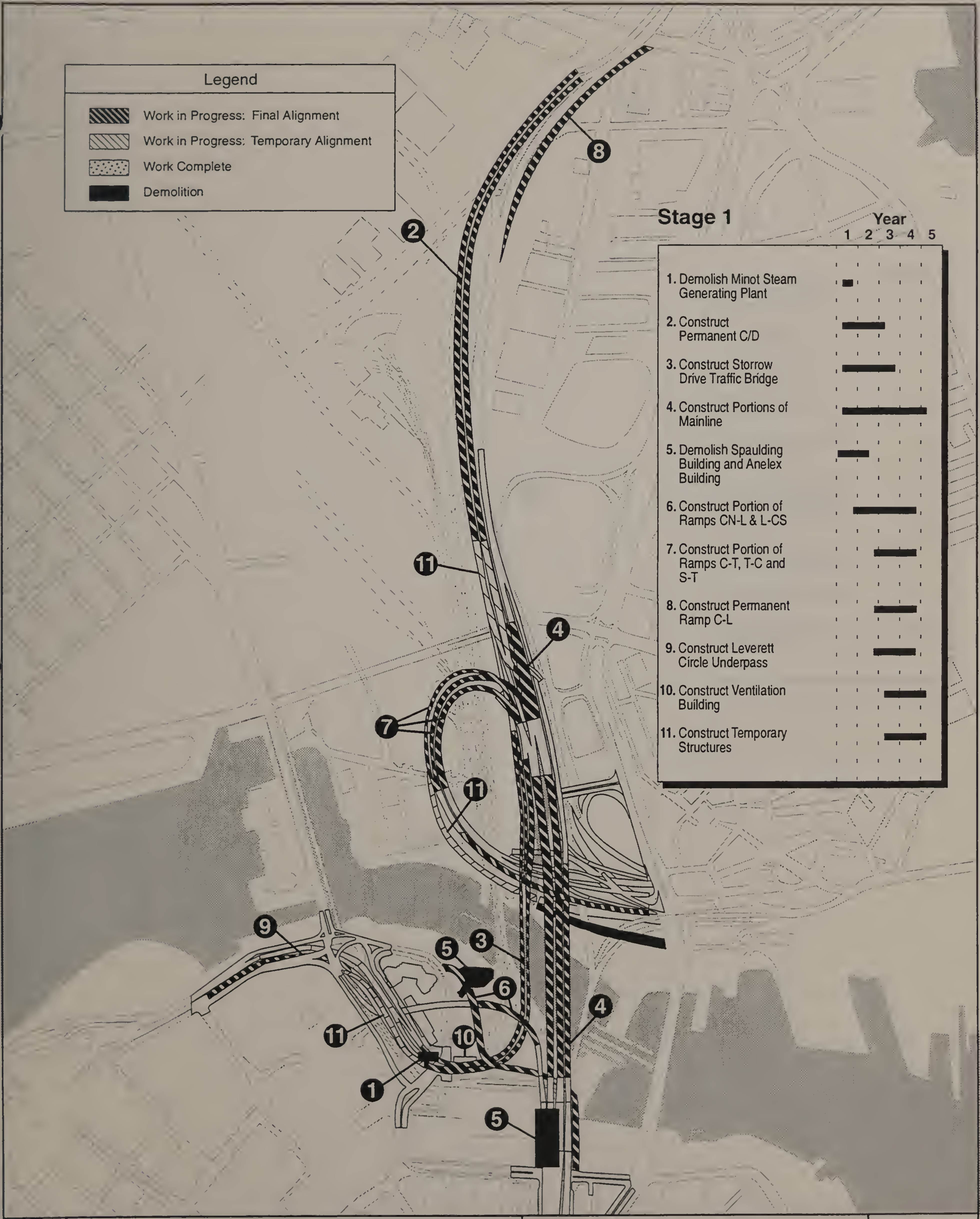
Stage 2. Completed in this stage are the I-93 northbound roadway (including the new cable-stayed bridge river crossing and viaduct structure) north of the Charles River, and the bent modification work required to merge the new structure into the existing roadway. The new underpass beneath Leverett Circle is completed, and the temporary viaduct structure constructed in Stage 1 is removed.

Stage 3. The I-93 southbound roadway is completed, including the new river Crossing and viaduct structure, and the bent modifications required for the southbound tie-in with the existing structure.

Stage 4. The existing I-93 river Crossing and viaduct structure is removed, the remaining ramps are completed, and final surfacing and park restoration work are also completed. The Crossing is opened to all traffic.

5.1.5 Maintenance Of Traffic Summary

The construction staging plans for the Preferred Alternative are intended to minimize interference with traffic operations on the existing roadway network and to facilitate an efficient transition to the new roadway in stages. Most of the new facilities can be built with no impact on the existing roadway network, but in three areas construction staging involving temporary roadways


Legend
▨ Work in Progress: Final Alignment
▨ Work in Progress: Temporary Alignment
░ Work Complete
■ Demolition
Stage 1
Year
1 2 3 4 5
1. Demolish Minot Steam Generating Plant
2. Construct Permanent C/D
3. Construct Storrow Drive Traffic Bridge
4. Construct Portions of Mainline
5. Demolish Spaulding Building and Anelex Building
6. Construct Portion of Ramps CN-L & L-CS
7. Construct Portion of Ramps C-T, T-C and S-T
8. Construct Permanent Ramp C-L
9. Construct Leverett Circle Underpass
10. Construct Ventilation Building
11. Construct Temporary Structures
1
2
3
4
5
6
7
8
9
10
11
0
600
1400 FEET

FIGURE

5.2

Construction Stage 1
Preferred Alternative

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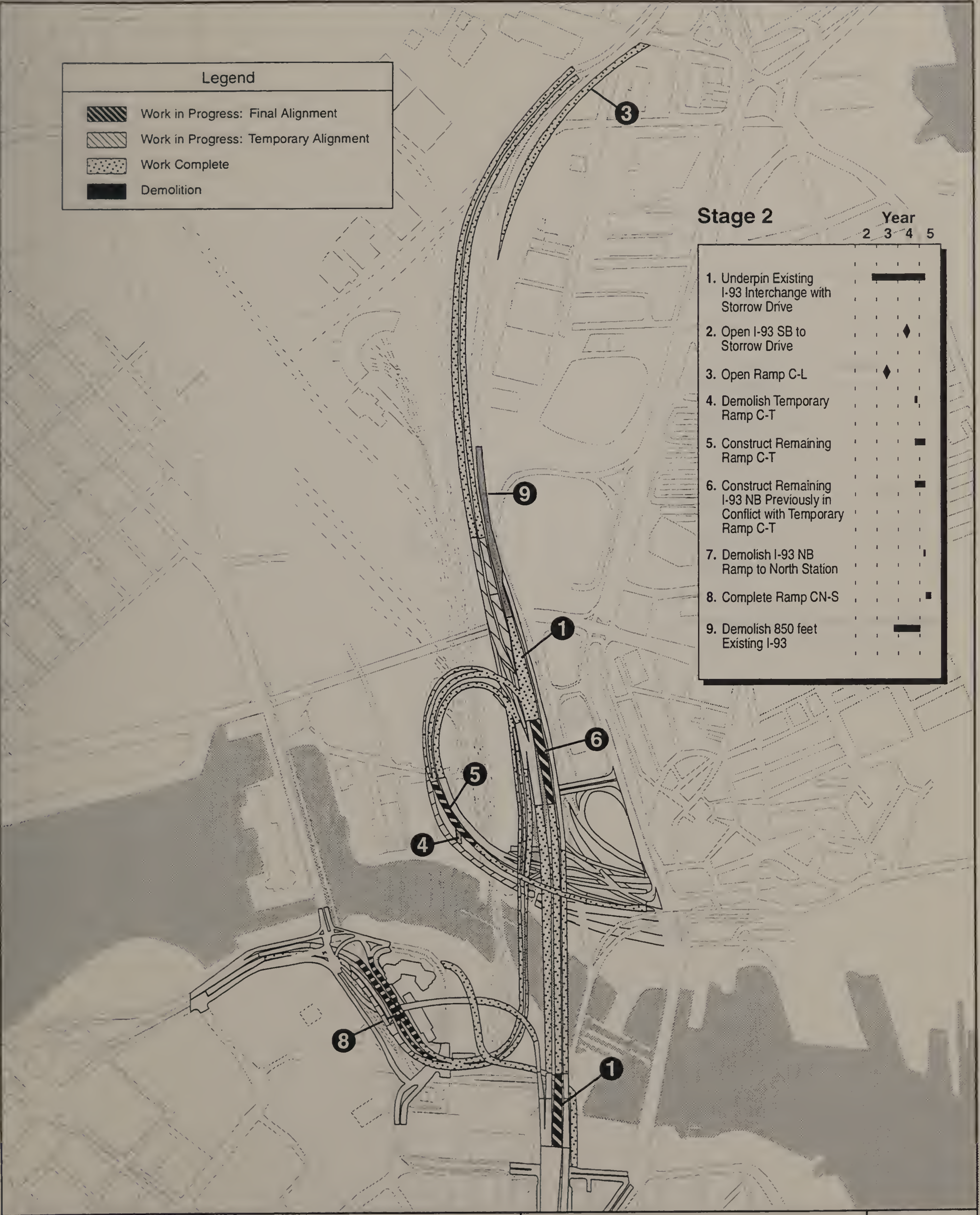
Legend
▧ Work in Progress: Final Alignment
▨ Work in Progress: Temporary Alignment
░ Work Complete
■ Demolition
1
1
3
4
5
6
8
9

Stage 2

Year 2 3 4 5

1. Underpin Existing I-93 Interchange with Storrow Drive
2. Open I-93 SB to Storrow Drive
3. Open Ramp C-L
4. Demolish Temporary Ramp C-T
5. Construct Remaining Ramp C-T
6. Construct Remaining I-93 NB Previously in Conflict with Temporary Ramp C-T
7. Demolish I-93 NB Ramp to North Station
8. Complete Ramp CN-S
9. Demolish 850 feet Existing I-93

FIGURE

5.3

Construction Stage 2
Preferred Alternative

Charles River Crossing FSEIS/R

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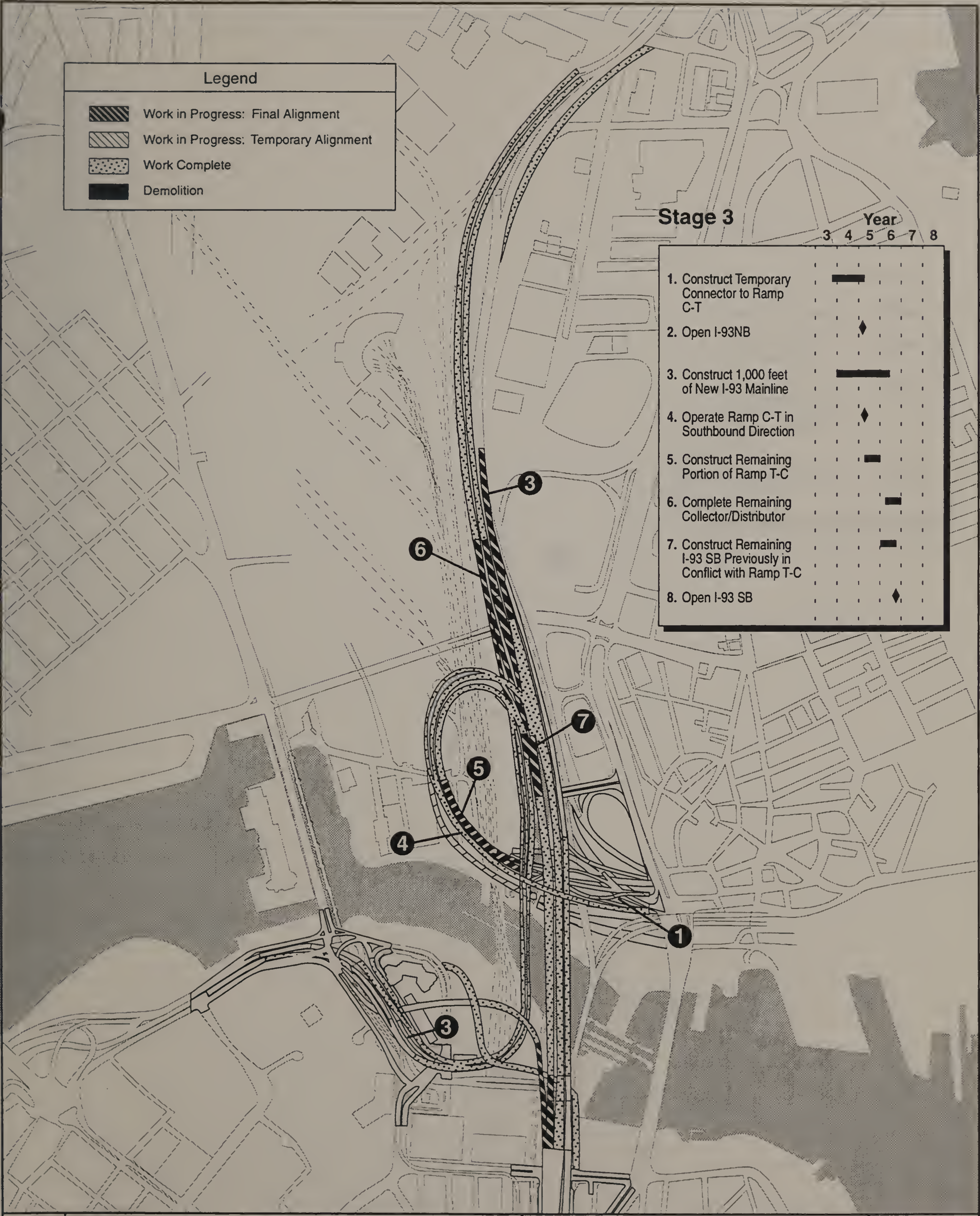
0 600 1400 FEET


Legend
▨ Work in Progress: Final Alignment
▨ Work in Progress: Temporary Alignment
░ Work Complete
■ Demolition
Stage 3
Year
3 4 5 6 7 8
1. Construct Temporary Connector to Ramp C-T
2. Open I-93NB
3. Construct 1,000 feet of New I-93 Mainline
4. Operate Ramp C-T in Southbound Direction
5. Construct Remaining Portion of Ramp T-C
6. Complete Remaining Collector/Distributor
7. Construct Remaining I-93 SB Previously in Conflict with Ramp T-C
8. Open I-93 SB
3
6
7
5
4
1
3

FIGURE

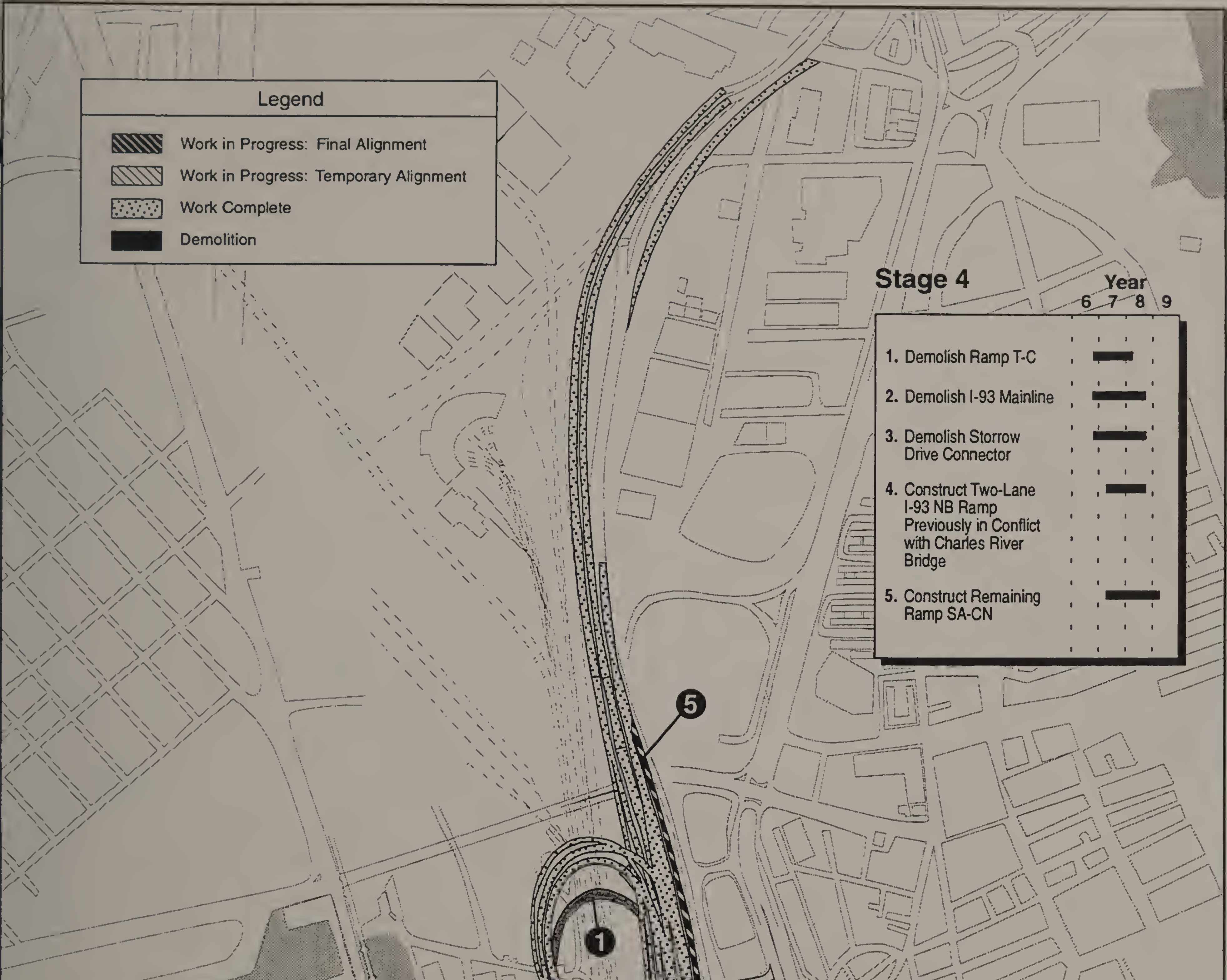
5.4

Construction Stage 3
Preferred Alternative

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 600 1400 FEET


Legend
▨ Work in Progress: Final Alignment
▨ Work in Progress: Temporary Alignment
▒ Work Complete
■ Demolition
Stage 4
Year
6 7 8 9
1. Demolish Ramp T-C
2. Demolish I-93 Mainline
3. Demolish Storrow Drive Connector
4. Construct Two-Lane I-93 NB Ramp Previously in Conflict with Charles River Bridge
5. Construct Remaining Ramp SA-CN
①
②
③
④
⑤

FIGURE

5.5

Construction Stage 4
Preferred Alternative

Charles River Crossing FSEIS/R

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0 600 1400 FEET

is critical:

- Leverett Circle/Storrow Drive
- existing to new I-93 transition
- Route 1 to I-93 connection

In order to widen the Leverett Circle/Nashua Street corridor, improvements to Leverett Circle, Nashua Street, Martha Road, and Lomasney Way must be made prior to construction of the connecting ramps to provide an adequate number of travel lanes through all construction stages. Leverett Circle must undergo several configuration transitions during construction in order to maintain both vehicular and pedestrian movements.

The on/off-ramps to and from I-93 are replaced by temporary ramps at times during the construction period. The transition from existing to new highway sections is accomplished by temporary connections between construction stages. Most of the temporary connections are within the highway right-of-way and do not affect the surrounding roadway network.

The Route 1 and I-93 connection is maintained as follows. Temporary ramps are constructed connecting both CANA and the new C-T/T-C ramps to allow traffic to and from Route 1 to I-93. The new Ramp C-T operates in various directions for a period of time when temporary CANA Ramps C-T and T-C are being demolished to make way for the new Ramp T-C.

5.1.6 Commuter Railroad Impact

The proposed loop ramps from I-93 to/from Route 1 in Charlestown cross over MBTA commuter railroad tracks on the approach to North Station on the north side of the Charles River. The bents supporting these elevated ramps are constructed so that commuter railroad operations are not disrupted. Refer to Section 5.1.3 for the discussion on the North Station commuter railroad impacts. Farther north, the collector/distributor roadway is constructed through a corridor of the railroad right-of-way. Also here, construction is scheduled so as not to affect the commuter railroad operations.

5.1.7 Construction In The Charles River

The Storrow Drive connector bridge (Ramps N-S and S-N) and the I-93 mainline bridge require construction in and on the shores of the Charles River. All operations are structured so that river traffic is not seriously affected and so that the river is not degraded environmentally.

The north bridge tower has one leg extending some 25 feet into the water. A cofferdam is constructed on the water side. On the south side of the river there is a similar cofferdam built some 75 feet into the water.

The Storrow Drive connector bridge is envisioned to have two piers in the Charles River, both behind the pier line. Construction is staged so that impacts on navigation are minimized. The contractor will be instructed to install buoys (per U.S. Coast Guard directions) for the safety of river traffic. A turbidity control curtain is installed during the short periods that excavation takes place.

5.1.8 Construction In The Millers River

In order to construct two of the ramps connecting local Rutherford Avenue traffic to and from I-93 northbound as well as to and from Route 1 northbound, the northern half of the Millers River will have to be filled. This will also include a service road access to the BSG facility. The southern half of the river nearest the Charles River will be retained as is.

Construction will be conducted to maintain the functions of this water body as much as possible. Mitigation measures include providing a new water feature in the North Point area described in Chapter 6.

5.1.9 Mitigation Measures

Construction mitigation measures, including protection of existing facilities in the construction zone which is standard, are described in detail in the Appendix to the Projectwide FSEIS/R. Specific to the Charles River Crossing in the Area North of Causeway Street are the following measures:

Construction Methods. Certain construction methods to protect facilities in the construction zone will be employed. These include the following: protecting the MBTA Orange Line tunnel and the Leverett Circle underpass; underpinning and bracing the MBTA Green Line on viaduct, including the Science Park station, and the Registry building; and monitoring movement at the Science Park station.

Traffic Maintenance. In addition to the traffic detour plan described in Section 5.1.5, the following measures will be employed: uniformed traffic personnel will be assigned as needed; traffic markings and signals will be installed at key intersections; and, a motorist information system will be implemented, as already currently provided in other construction zones of the Project.

Other Measures. Other measures pertaining to maintenance of utility service, dust/debris control, and construction noise and vibration will be employed as already currently provided in other construction zones of the Project.

5.2 HAZARDOUS CARGO ROUTES

Since the existing primary hazardous cargo routes travel through and adjacent to construction zones, the possibility exists that these routes may be affected by a construction incident or related activity. Should this occur, alternate routes will need to be employed. To prepare for this possibility, hazardous cargo vehicle route alternatives will be developed for each construction contract as part of the emergency response plan for the contract. These route alternatives will then be submitted in advance to the appropriate local officials.

5.3 MATERIALS DISPOSAL

The materials disposal requirements for the Preferred Alternative are greater than those in Scheme Z. The differences in impacts of the materials disposal program for each design are negligible. There are comparable opportunities for beneficial reuse of excavated and dredged material for both designs. The preliminary estimates of the volumes of dredged and excavated materials are shown in Table 5.1.

5.3.1 Dredged Material

5.3.1(a) Characterization And Volume

Dredged material consists of underwater materials to be removed for bridge piers and footings. Dredged materials are characterized in this report as either acceptable or unacceptable for unconfined ocean disposal at the Massachusetts Bay Disposal Site (MBDS). A preliminary chemical characterization of an earlier river tunnel alignment, conducted in 1992, found that the Charles River organic sediment layer contains consistent Category 3 levels of heavy metals and PCBs, as characterized by the Massachusetts Dredged Material Classification Program pursuant to criteria contained in 314 CMR 9.00. Those Category 3 sediments are not suitable for ocean disposal. Only arsenic and nickel were found to be consistently below Category 3 levels. Sediments were tested for such chemicals as priority pollutant metals, petroleum hydrocarbons (PHC), PAH, and PCBs. Based on the above data, it is assumed that the top 8 feet of soft sediments in the Charles River will be unacceptable dredged material. Further testing and characterization of bridge piers and footing locations will be performed during the permitting process to precisely determine the volume of acceptable and unacceptable dredged material.

Preliminary estimates of acceptable and unacceptable dredged materials quantities for the Preferred Alternative and Scheme Z shown in Table 5.2. These quantities are based upon the construction method described in Section 5.1.1.

5.3.1(b) Disposal Alternatives

Disposal alternatives for unacceptable dredged material were analyzed in the 1991 FSEIS/R (Part IIB, Chapter 4, Section 4.7). Disposal site alternatives are limited for unacceptable dredged material because of the material's chemical contamination, water content, and salt content. Disposal site alternatives analyzed included the unconfined ocean disposal at the MBDS, confined aquatic disposal (CAD) options such as Spectacle Island, Hull Bay, and the Logan Airport north and west borrow pit sites; and upland sites including Spectacle Island, the Neponset Drive-in/Hallet Street landfill, Squantum Point, Governors Island (Logan Airport), and the Lynn Harbor Transcontinental Development Corporation (TDC) site. The disposal option for the unacceptable dredged material in the 1991 FSEIS/R was upland disposal at Spectacle Island.

It is anticipated that unacceptable dredged material, though contaminated, will not be heavily contaminated and could be used as fill within the Project area. This use would minimize truck or barge traffic. Unacceptable dredged material will be stabilized and placed in the portion of the Millers River to be filled.

Table 5.1
Preliminary Estimated Total Of Materials Disposal Volumes (in cubic yards)

Design	Dredged Material	Excavated Material	Total Volume
Preferred Alternative	44,000	450,000	494,000
Scheme Z	51,000	103,000	154,000

Source: Bechtel/Parsons Brinckerhoff

Table 5.2
Preliminary Estimates of Dredged Materials Acceptable And Unacceptable For Ocean Disposal At The MBDS (in cubic yards)

Design	Acceptable	Unacceptable
Preferred Alternative	36,000	8,000
Scheme Z	41,000	10,000

All assumed unacceptable in the 1991 FSEIS/R; revised figures are based upon subsequent sampling.
Source: Bechtel/Parsons Brinckerhoff

Table 5.3
Preliminary Estimates Of Excavated Material
(in cubic yards)

Design	Granular Historic Fill	Nongranular Historic Fill	Clay/Till	Organics	Asphalt/Waste
Preferred Alternative	133,000	92,000	113,000	154,000	20,000
Scheme Z	40,000	27,000	33,000	45,000	6,000

Source: Bechtel/Parsons Brinckerhoff

Acceptable dredged material will be transported by barge and disposed of at the MBDS. The existing locks at the Charles River Dam limit the size of barges which can pass through the locks. An ocean dump scow cannot traverse the locks; therefore, smaller deck barges will need to be used for transport of the dredged material through the locks. The dredged material would then be transferred from the deck barges to the larger ocean dump scow at a location in the Harbor outside of the Charles River basin. The existing barge loading facility at Subaru Pier in South Boston is being investigated for this purpose. The navigation impacts of the dredged material barges will be mitigated in accordance with the contractor's navigation plan as described in Section 5.10.3.

5.3.2 Excavated Material

5.3.2(a) Volumes

Excavated material consists of materials landward of mean high water to be removed for the land tunnels, boat sections, and viaduct column supports. Such excavated materials in the Charles River Crossing area include both native clay and till and historic fill materials. Excavation quantities for the Preferred Alternative are shown in Table 5.3. For comparison, excavation quantities for Scheme Z are included.

Historic fill comprises the upper layer over the Charles River Crossing Project area. Beneath the fill layer lies a band of silts, mud, and sand that comprised the surface materials of the Harbor and the Charles River estuary at the time of European settlement. Below these materials are layers of Boston blue clay and glacial till with the till generally overlaying the clay. Beneath the till is bedrock. Depth to bedrock is shallow on the Cambridge side of the alignment.

5.3.2(b) Native Clay And Till

The 1991 FSEIS/R proposed landfill capping as a beneficial reuse for excavated native clay and till. This beneficial reuse is also proposed for the 113,000 cy of clay and till excavated for the Preferred Alternative.

There is ample capacity at the proposed South Boston MPO to handle the quantities of excavated material under the Preferred Alternative. Trucks would travel from the construction site to I-93 southbound, then proceed to the South Boston Bypass Road and to the MPO site off Congress Street. Trucks will be restricted to designated haul routes in Boston and Cambridge to minimize impacts to local streets.

An analysis of truck traffic leaving the site of excavation and travelling to the MPO site in South Boston has shown that impacts to local streets in Cambridge and Charlestown are negligible. Roughly 50 percent of excavation occurs on either bank of the Charles River, so local truck impacts are distributed equitably. Excavation truck trips are a small portion of total traffic.

5.3.2(c) Historic Fill

The 1991 FSEIS/R also proposed that excavated historic fill be processed at the proposed MPO site in South Boston for beneficial use as landfill cover or Project backfill. All MPO output is subject to multiple testing criteria for chemical contamination in accordance with a February 5, 1993, Memorandum of Understanding between MHD and DEP. MPO output will meet these chemical limits for the specific end use as either landfill cover or backfill.

Nongranular historic fill will be processed for use as cover material and marketed to solid waste landfills, as described in the February 5, 1993, Memorandum of Understanding with DEP. Granular historic fill material will be processed to meet physical specifications for use as backfill along the Project alignment. Construction of the Preferred Alternative will require 201,000 cy of backfill. Scheme Z does not require appreciable amounts of backfill. Potentially, all of the Preferred Alternative backfill requirements could be met through the use of excavated historic fill from the alignment. Granular historic fill which cannot be processed for use as backfill can be processed for use as landfill cover or shaping material. Historic fill and clay and till will be used to close and cap abandoned landfills such as the City of Boston landfill at the Hallet Street/Neponset Drive-in site.

5.3.2(d) Organics, Waste Material, And Asphalt

Organic, nonsoil solid waste, and asphalt paving materials will be part of the excavated materials for the Preferred Alternative. Organic materials include untreated timber pile fragments, wood, stumps, and peat, but specifically excludes any material defined as solid waste under State regulations. Waste materials include manmade objects, such as chemically treated timber piles, metals, plastics, and other similar materials.

Organic materials will be processed for reuse or disposed of at landfills. Asphalt material can be recycled at an asphalt recycling facility for reuse in either cold patch or hot mix asphalt products. Waste materials will be disposed of at Massachusetts landfills.

5.3.3 Conclusion

Excavated materials will be transported to the proposed South Boston MPO site for processing into Project backfill (granular fill) or landfill cover or shaping material (nongranular fill) or for distribution to municipal landfills to be used in DEP-approved landfill closures (clay/ till). If markets for these materials prove unavailable when required for disposal of this material, the excavated soil would be transported out of State for disposal in landfills or other authorized disposal locations. Organic and waste materials will be properly disposed of by Project contractors.

Dredged materials will be disposed of in accordance with regulatory requirements. Dredged materials unacceptable for ocean disposal from the Charles and Millers Rivers will be stabilized and placed in the portion of the Millers River basin which will be filled to create the surface roadways. Acceptable dredged materials from the Charles and Millers Rivers will be transported by barge for disposal at the MBDS.

5.3.4 Mitigation Measures

Mitigation for the Preferred Alternative materials disposal program include the following:

- movement of dredged material barges through the locks of the Charles River Dam will be governed by the contractor's navigation plan developed with the U.S. Coast Guard and the MDC

- trucks loaded with excavated material will travel only on designated haul routes

- positive turbidity control measures such as sheet pile enclosures and silt booms will be employed at dredged material loading and transfer locations in the Charles River and Boston Harbor

5.4 LAND USE IMPACTS

Construction period impacts on land use will be primarily noticeable south of the Charles River and will be similar for the Preferred Alternative and Scheme Z. The timing of future developments by others will affect the degree of impact.

The Preferred Alternative will affect the timing of development on the MGH development parcel along Nashua Street, and the new ramps under the MBTA commuter railroad air rights garage parcel will affect the timing and potential size of this proposed development.

In addition, development of the remaining segments of the Spaulding Rehabilitation Hospital site, to be taken for the Nashua Street off-ramp, will be delayed until completion of construction. The 100-foot-wide strip on the riverside portion will be developed as early as feasible during the construction process. No other land use development projects by others on the south bank of the Project subarea are expected to be delayed by Project construction.

On the north bank, the development schedule for affected parts of the North Point housing/parking garage development will have to be coordinated with the development schedule for the new riverside parkland and the new water feature proposed as part of the New Charles River Basin mitigation program (see Chapter 6).

In addition, during construction the CANA project ramp stubs (C-L and T-C) will be removed, in order to reduce the amount of ramp structures in the area planned for open space and parkland. This mitigation measure is necessary due to the design change posed by the Preferred Alternative. These stubs would have been connected to the mainline structure in Scheme Z.

5.5 ECONOMIC IMPACTS

Since the publication of the Projectwide FSEIS/R in November 1990, the economy of the region has continued to weaken significantly. For the past 4 years, all sectors of the regional economy have experienced some form of slowdown, with job losses occurring in many of the region's traditionally strong industry sectors such as high technology and computer manufacturing. These industry losses, coupled with a more widespread slowdown nationally, have affected economic activity in the study area far more than potential impacts of Project construction. It is important to place in this context any retail, office, or industrial businesses losses which may have occurred in the study area since the start of Project construction activities in 1991. In fact, in light of recent job losses in the regional economy, the jobs being created by the construction of the Project have gained in relative importance to the region's economy.

Construction activities associated with the Preferred Alternative or Scheme Z will affect three buildings in the Area North of Causeway Street: Spaulding Rehabilitation Hospital, the Registry building, and the Boston Thermal Energy Corporation's Minot Station steam generating plant. The Preferred Alternative requires the taking of the Spaulding Rehabilitation Hospital; Scheme Z does not. MHD will cooperate with MGH and City of Boston to relocate the hospital nearby. The Registry is already planning to move its operation to Parcel 18 in Roxbury by mid-1994, so its operations will not be affected. The Registry building would remain, but be underpinned to allow land-based tunnel construction beneath it, unless the building owners, with proper approval, wishes to remove the building during Project construction. Scheme Z does not affect the Registry building. The future relocation of Boston Thermal's Minot Station function is under study by BTEC, funded by MHD. The existing plant building will be displaced by the Preferred Alternative. Scheme Z only affects the ice facility of the plant and not the plant building.

Construction activities associated with the Preferred Alternative may potentially create a marginally greater temporary impact on North End businesses than Scheme Z. This is due to the addition of the New Sudbury Street on-ramp to I-93 northbound and the connection of the Sumner Tunnel to Storrow Drive by transferring some local traffic to the interstate system. As discussed in detail in the FSEIS/R, the construction activity may affect businesses located in the vicinity by hindering access for employees and customers, thereby potentially affecting the ability to operate a business in that location, and therefore result in lost sales or income. The extent to which any given business would be affected depends on its exact location, the nature of its product or service, the mode of access for customers and employees, and whether the business has primarily pass-by customers or those who come to the establishment as a destination. As under Scheme Z, it is anticipated that traffic maintenance, signs, and adequate parking will assist in countering those potential temporary impacts during construction. This will be consistent with ongoing construction mitigation commitments.

5.6 CULTURAL RESOURCES IMPACTS

The following sections describe short-term, temporary construction period impacts of the Preferred Alternative on historic and archaeological resources, as compared to Scheme Z.

5.6.1 Historic Resources

5.6.1(a) Background

In order to mitigate construction period effects, Stipulations 1 through 4 of the 1984 Section 106 Memorandum of Agreement continue to apply to the Area North of Causeway Street and to those parts of the Central Area that are affected by design changes for the Charles River Crossing. These stipulations are described in detail in the 1991 FSEIS/R Appendix, Construction Mitigation.

As directed by Stipulation 4 of the MOA, all potential adverse effects from construction (such as vibration and soil movement impacts) will be mitigated through review of design and construction specifications by the Project Conservator. In consultation with the Section 106 agencies during the spring of 1993, MHD has developed standard procedures for the review of historic resources throughout design and construction work. This mitigation process is the principal mechanism for addressing adverse impacts.

As further detailed in the above-referenced Appendix, the following construction procedures will also be applied:

- Vibration: Historic structures within 12 feet of slurry wall construction will be carefully inspected before design work is complete, and will be monitored and/or otherwise protected during construction. Historic structures more than 12 feet away from construction may also be monitored, in accordance with recommendations from the Project Conservator. In addition, all historic resources are subject to the Vibration Acceptance Criteria contained in DPM No. 1, Rev. 3, Appendix A, Rev. D (December 3, 1991), which recommends limits to the section design contractor that are subsequently reviewed by the Project Conservator.

- Pile driving: Alternative methods will be considered for pile driving operations that occur within 110 feet of historic structures. Pile driving is also subject to the Vibration Acceptance Criteria referenced above.

- Monitoring of groundwater and soil conditions: In areas of deep excavation, such as between North and Causeway Streets, depressurization undertaken to eliminate uplift may affect historic structures. Monitoring of groundwater and soil conditions will therefore be undertaken, and special construction methods such as slurry walls or steel sheetpile walls may also be used to reduce lateral movements, settlement, and groundwater influx.

5.6.1(b) Impacts And Mitigation

Specific short-term impacts during construction on the affected resources are described below.

Phipps Street Burying Ground. Because of its distance from the alignment in both designs, no construction period impacts to this historic property are expected.

Town Hill District. Neither design has a temporary construction period impact to the historic attributes of this district. In the Preferred Alternative, construction is farther away from the district than the existing I-93 highway structure.

15-18 City Square. Because of its distance from the alignment, no construction period impacts to this historic building are expected.

Charles River Basin District. The reconfiguration of Leverett Circle may have temporary construction period impacts on the historic Street Railway Viaduct, which carries the MBTA Green Line.

Current design developments indicate that slurry wall construction is likely to have no structural impacts on the viaduct. This will continue to be studied during further design development. In addition, no temporary construction impacts are expected on the historic Charles River Dam.

A new sewer pipe is located about 100 feet from the MDC Police Headquarters and Lock House, and reconstruction of the surface of O'Brien Highway will take place in front of this structure. No construction period effects to the historic building are expected, however.

Charlestown/North Washington Street Bridge. Because of its distance from the alignment, no construction period impacts to this historic structure are expected.

Granite Seawalls In The Lower Basin Of The Charles River. Construction of bridge footings and park improvements will have temporary impacts on the granite seawalls in this area. The Project Conservator will review the design and construction specifications for work in this area. Construction-related adverse effects will also be mitigated through Stipulation 2 of the MOA, which governs similar work at Fort Point Channel. This stipulation describes specific design guidelines for the reuse of existing material and for the characteristics of new construction. Any areas of the seawalls to be disturbed during construction would be carefully removed and stored prior to the commencement of activity in this area.

Tower A. Under the CANA project connection to Scheme Z, Tower A is demolished; Scheme Z has construction period impacts related to the placement of new viaduct ramps 2 to 4 feet over this building. The Preferred Alternative has no construction period impacts on Tower A.

100 Nashua Street. Scheme Z has no construction period effects on the historic Registry building. The Preferred Alternative has greater temporary construction impacts than Scheme Z, due to the location of a tunnel directly underneath the building. Underpinning is required and constitutes a potential adverse effect during construction. As mitigation, the deteriorating facade system will be stabilized before construction begins or, if necessary, it will be removed in whole or in part before underpinning occurs.

Causeway/North Washington Streets District. In the 1991 FSEIS/R, all buildings rated with a potential for medium to high impact by the Project Conservator are determined to be adversely affected by the construction of the northbound I-93 mainline tunnel in Scheme Z.

In the Preferred Alternative, northbound tunnels pass closer than Scheme Z to historic buildings, including within 15 to 25 feet of the Charles River Building, Braman Dow Building, and 6-24 Medford Street (all of which the Project Conservator rated medium to high in potential impact). Although slurry wall construction is likely to have no structural impacts on these buildings, potential construction impacts and mitigation will continue to be studied during design development.

Bulfinch Triangle District. In the 1991 FSEIS/R, all buildings rated with a potential for medium to high impact by the Project Conservator were determined to be adversely affected by the construction of the northbound I-93 mainline tunnel in Scheme Z. Similar tunnel construction in the Preferred Alternative will have no change in construction period effects from Scheme Z.

North End District. In the 1991 FSEIS/R, all buildings rated with a potential for medium to high impact by the Project Conservator are determined to be adversely affected by the construction of the northbound I-93 mainline tunnel in Scheme Z. Both designs have potential construction period impacts due to the location of a northbound tunnel within 10 to 15 feet of the historic buildings and streetscape at Stillman Place (which was given a very high potential impact rating by the Project Conservator), and within 20 feet of historic buildings at 45-51 and 53-65 North Washington Street (both of which were given a high potential impact rating by the Project Conservator). In both designs, slurry wall construction near Stillman Place is required. Potential construction impacts and mitigation will continue to be studied during design development.

Unlike Scheme Z, the Preferred Alternative also has potential adverse impacts from the construction of the surface road within 10 feet of Stillman Place, which is closer than in Scheme Z. Any historic paving materials or bollards to be disturbed would be carefully removed and stored, prior to the commencement of activity in this area.

5.6.1(c) Summary

Adverse effects during construction are due primarily to construction activities associated with the I-93 mainline tunnels, particularly on the historic districts south of the Charles River. In order to be consistent with the 1991 FSEIS/R, the determination of adverse effect has been carried over to all the historic resources considered in this document. The slurry wall construction proposed for all the tunnels in the affected area is inherently designed to avoid construction-related vibration or movement in adjacent structures. The mitigation procedures established by the 1984 MOA will be applied during design and construction, should any unforeseen conditions arise.

5.6.2 Archaeological Resources

The completed Phase I/Step I survey analyzed the impacts of Scheme Z and three new alternatives in the 1993 DSEIS/R. The study identified four potentially significant archaeological resources to be affected by these four designs: (1) prehistoric sites within the former Millers River embayment; (2) a tide mill at Mill and Essex streets; (3) the terminus of the Middlesex Canal at Charlestown Neck; and (4) the archaeological remains of 19th century tenement buildings.

The Preferred Alternative reduces the inventory of potential archaeological resources to: (1) prehistoric sites within the former Millers River embayment; and (2) the archaeological remains of 19th century tenement buildings. Scheme Z affects only potential prehistoric sites within the former Millers River embayment.

The potential sites to be affected by the Preferred Alternative will be subjected to archaeological monitoring during the geotechnical study and the construction phases of the Project. Archaeological investigation will include limited subsurface testing to locate and evaluate archaeological resources. Construction impacts to any identified significant archaeological sites will be avoided by adjusting the placement of viaduct footing locations, changing the construction methods to reduce impacts, or undertaking Phase II site examinations.

Areas with a lower probability of significant and intact resources will be monitored during construction, in accordance with the 1984 MOA, which outlines the Project's commitment to archaeological resources. Should evidence of significant Prehistoric or Historic period sites be detected during construction, the Project's existing mitigation program, as described in the 1991 FSEIS/R, would go into effect. Such sites would undergo archaeological work under the terms of the Project's contingency plan, MHC regulations, and the existing MOA.

5.7 UTILITIES

This section identifies the temporary construction period impacts to utilities the Preferred Alternative and Scheme Z (see Figure 5.6 for location of existing major utilities). There are no long-term impacts to utilities because all systems will be restored to their current status. Either design will require relocations of many public and private utilities within the Area North of Causeway Street and at Leverett Circle. Utility systems to be relocated include the following: water, wastewater, drainage, electric, gas, telephone, and steam. All existing systems in conflict must be kept in service until suitable replacement facilities are constructed and activated. The utility relocation work must occur early in the construction phase to meet schedule requirements. The major impacts to utility systems are described below.

5.7.1 BTEC Minot Station Steam Generating Plant

The Boston Thermal Energy Corporation's (BTEC) Minot Station steam generating plant is taken under the Preferred Alternative to provide space for ramps at Leverett Circle. This taking is not required for Scheme Z. MHD and BTEC have discussed the following mitigation alternatives:

- upgrade the existing steam plant at Kneeland Street to replace capacity
- construct a replacement plant
- relocate existing facilities in the new ventilation building on the south side of the Charles River

MHD has entered into a force account agreement with BTEC, which provides for a detailed study of mitigation alternatives. Based upon the results of this study, MHD will cooperate and coordinate with BTEC to institute appropriate measures to support the construction of the Preferred Alternative and the operational needs of BTEC.

5.7.2 BWSC West Side Interceptor And Nashua Street Overflow

The Boston Water and Sewer Commission (BWSC) is concerned about the 36-inch by 54-inch West Side Interceptor (WSI) and the 72-inch by 90-inch Nashua Street Overflow (NSO) in this area. Portions of these facilities will have to be relocated under project structures because of roadway and tunnel work at Leverett Circle, Nashua Street, and Storrow Drive. The WSI originates in Causeway Street and flows toward the Charles River at Nashua Street, where the NSO acts as a wet weather relief for both the WSI and the Massachusetts Water Resources Authority's (MWRA) Boston Marginal Conduit (BMC). Relocation work is required for both the Preferred Alternative and Scheme Z. BWSC has indicated that any replacement work that involves either siphons or pumping stations is undesirable.

5.7.3 BECo 345 kV Electrical Transmission Line

Boston Edison Company (BECo) maintains a 345-kV electrical transmission cable and conduit system in the Area North of Causeway Street. This system consists of two conduits in the Leverett Circle area, four conduits (including two spares) under the Charles River, and two conduits in Cambridge. Only one conduit is active now; the second one will be operational in the late 1990s depending on electricity demand. The purpose of this system is to provide bulk power to downtown Boston. The operation of this line is a function of electrical generation patterns at BECo power plants in Everett and South Boston.

This system would have to be relocated in the Leverett Circle area because of ramp construction for the Preferred Alternative. Scheduling of replacement cable and conduits under the river is an important consideration because of the length of time required. Scheme Z does not affect this system. Creation of a new water feature at North Point may affect these cable and conduit systems (see Chapter 6).

5.7.4 MWRA Combined Sewer Force Main

The MWRA maintains several combined sewer (CS) facilities in the Area North of Causeway Street. These facilities include the Charles River Marginal Conduit (CRMC), the Prison Point Combined Sewer Outfall (CSO) Pump Station in Cambridge, and two CS force mains that discharge from the pump station. The CRMC is an 84-inch inverted siphon under the Charles River that connects the BMC and WSI in Boston to the Prison Point CSO facility in Cambridge. These facilities are not affected by the Preferred Alternative.

The CS force mains include an 18-inch dry weather connection into a BWSC (29-inch by 37-inch) CS at Front Street in Charlestown, and a 96-inch wet weather reinforced concrete cylinder pipe that discharges into the Charles River downstream of the Charles River dam. The CRMC and two force mains may be affected by the Preferred Alternative or Scheme Z because of the locations of the bent structures for the viaducts.

5.7.5 Other Utility System Conflicts

In addition to the conflicts described above, there will be routine utility relocation work required at Leverett Circle, the CANA loop ramp area, and at Causeway Street/Accolon Way.

5.7.6 Storm Drainage Rerouting

Due to the placement of fill and viaduct piers, the Preferred Alternative will affect drainage systems that discharge into the Millers River. The surface storm drain (54-inch) from the I-93 viaduct will be rerouted to the Charles River, downstream of the new dam. The other drainage systems will be extended through fill and will continue to discharge similar to existing conditions to the Millers River. These drainage systems are as follows:

- Three storm drains (48-inch) from the MBTA ROW

- One BWSC storm drain (72-inch) from Rutherford Avenue, Charlestown

5.7.7 Mitigation

The most significant mitigation requirement for utilities systems is the replacement or relocation of the BTEC steam generating plant. MHD and BTEC have agreed to conduct a study on this issue. BTEC will develop the analysis under a force account arrangement. The service will be maintained during relocation of any affected utility facility.

5.8 AIR QUALITY

Construction-related air quality impacts will be caused by detouring and disrupting traffic (mobile emissions including CO sources), and the demolition, land clearing, grading, excavation, and other earthwork activities (fugitive particulate emissions including fugitive dust sources). The type and nature of these construction activities are not expected to be substantially different for the Preferred Alternative and Scheme Z when they are compared to the entire Central Artery/Tunnel Project.

The construction-related air quality impacts for the entire Project are being evaluated through a series of analyses, pursuant to the Memorandum of Understanding (MOU) signed by MHD, FHWA, EPA, and DEP as part of the May 1991 Record of Decision of FHWA. The Construction Air Quality Committee of the Project, formed for the purpose of evaluating and minimizing these impacts, meets on a regular basis to discuss study methodology, results, and mitigation measures to minimize potential construction-related air quality impacts. This process will be continued throughout the construction of the Project, including the Charles River Crossing. The specific construction air quality impacts associated with the Preferred Alternative will be evaluated under the same ongoing MOU process described above.

The analyses currently being used to estimate construction impacts include a process that: (1) estimates traffic volumes at specific locations during major construction phases (this is part of the maintenance of traffic plans for each construction contract area prior to construction activities); (2) estimates CO levels at intersections likely to be affected by construction detours and truck routing; (3) evaluates areawide emissions; and (4) estimates construction-related dust levels near major construction sites.

5.9 NOISE AND VIBRATION

5.9.1 Impacts

Construction noise and vibration impacts are related to intensity of construction noise and vibration sources and their distance to sensitive receptors. Information on the sources of construction noise and vibration, Project design criteria, and methodology for assessing construction noise and vibration impacts are described in Chapter 20 (Section 20.2.5) of the 1991 FSEIS/R and in its Noise and Vibration Appendix. This information is not repeated here.

Construction period noise impacts are somewhat less

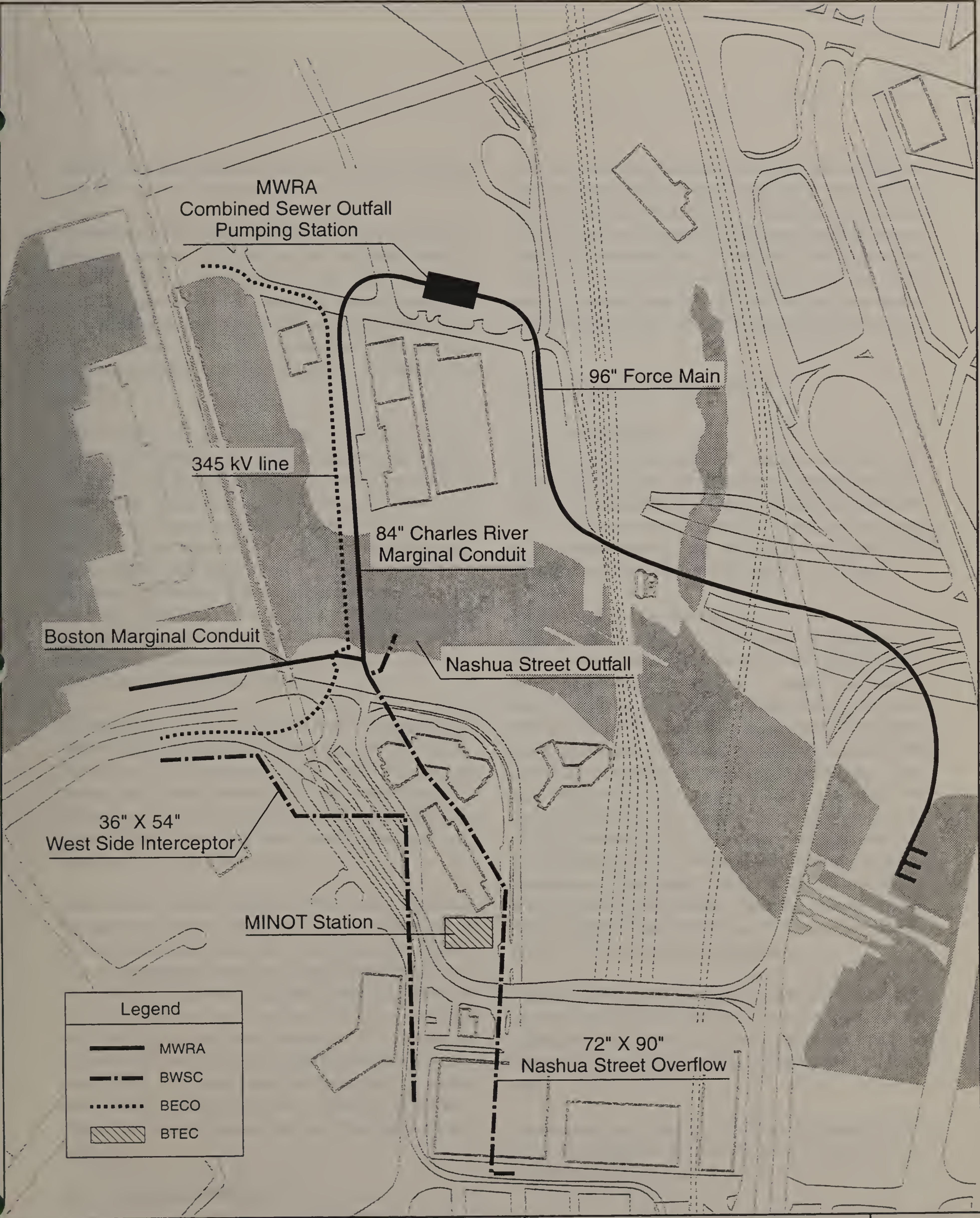

MWRA
Combined Sewer Outfall
Pumping Station
96" Force Main
345 kV line
84" Charles River
Marginal Conduit
Boston Marginal Conduit
Nashua Street Outfall
36" X 54"
West Side Interceptor
MINOT Station
72" X 90"
Nashua Street Overflow
Legend
MWRA
BWSC
BECO
BTEC
0
100
200
300
400
500 FEET

FIGURE 5.6

Location of Existing Major Utilities

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

5.10.1(b) State Resources

Bordering Vegetated Wetlands. Scheme Z alters 350 sf of BVW in the Millers River, and the Preferred Alternative alters 510 sf of BVW due to construction of the proposed intersection. While these alterations are temporary impacts, for purposes of this analysis they are assumed to result in permanent losses of vegetation, and are therefore considered permanent losses. These impacts are presented in Table 4.28, Permanent Impacts to State Wetland Resource Areas, found in Section 4.5.2.

Banks. Construction activities under either design affect banks (see Table 5.5). Along the Charles River, these activities include the construction of cofferdams and footings for piers to support the I-93 bridges and to support the Storrow Drive-to-Tobin Bridge ramps for a total temporary disruption of 100 lf in Scheme Z and 75 lf in the Preferred Alternative.

In the Millers River, Scheme Z temporarily affects 110 lf of bank as a result of pier construction. The Preferred Alternative temporarily affects 30 lf of bank as a result of piers and filling the northern portion of the river.

Land Under Water. LUW in the Charles River is temporarily affected by construction activities including the installation of sheetpile cofferdams and footings for piers for a total of 0.4 acre in Scheme Z and 0.14 acre in the Preferred Alternative.

LUW in the Millers River has construction-related temporary impacts during installation of sheet pile cofferdams, footings, and piers under both schemes. Additional temporary impacts occur for the Preferred Alternative to allow the placement of fill for the at-grade intersection. This totals 0.1 acre for Scheme Z and 0.2 acre for the Preferred Alternative.

Bordering Land Subject To Flooding. Construction activities result in temporary effects to BLSF along the Millers River (see Table 5.6). Activities include the construction of cofferdams and footings for piers under both alternatives and activities related to filling in the river under the Preferred Alternative.

The proposed activities have no effect on flood storage or storm damage, as the Charles River Dam controls the flood level of these water bodies.

Mitigation Measures. Various construction techniques will be implemented to minimize construction period impacts to wetlands resource areas. The proposed construction of bridge piers, including removal of bottom material, will occur within cofferdams to confine in-water activities. It is anticipated that those bridge piers which will be located within 50 feet of the shoreline will be constructed from land. Silt curtains and other devices will be used to control erosion and sedimentation during construction.

Summary. The Preferred Alternative and Scheme Z have adverse construction period impacts which occur for an extended period of time; however, these impacts occur in a limited geographic area and will be largely mitigated through appropriate construction control measures.

5.10.2 Waterways Impacts

Various construction-related activities result in temporary impacts to flowed waterways resources including installation of cofferdams and footings for piers, and removal of existing piers and structures. Temporary impacts to filled tidelands also occur during construction of surface roads, viaducts, cut-and-cover tunnels, and ventilation buildings; relocation and installation of utilities; and demolition and underpinning of various structures.

5.10.2(a) Flowed Tidelands

Construction activities temporarily affect the Charles River. Scheme Z and the Preferred Alternative require the demolition of the existing I-93 bridge over the Charles River and removal of all but one pier. Construction of new bridge piers, pylons, and a pylon footing in the river require the installation of sheet pile cofferdams and construction of footings. All footings except for a portion of a 60-foot by 60-foot footing needed for the mainline tower on the north side of the river, are placed below the mudline. A navigation plan will be developed in conjunction with the U.S. Coast Guard as described in Section 5.10.3.

In the Millers River, construction impacts result from the installation of bridge and ramp piers from both designs. The Preferred Alternative requires construction activities associated with filling in the northern portion of the river to accommodate the access ramps.

Table 5.4

BUILDINGS POTENTIALLY AFFECTED BY CONSTRUCTION VIBRATION

ID#	Name	Approximate Address	Approximate Distance (ft)*	
			Preferred Alternative	Scheme Z
0.7	Hoffman Building	Lovejoy Wharf	80	110
0.8	Stop and Shop Building	226-246 Causeway Street	50	110
0.13	Anelex Building	146-154 Causeway Street	110	110
H.31	Charles River Park Apts.	333 Charles Street	110	-
H.32	Charles River Park Apts. swimming pool	389 Charles Street	80	70
G.33	Registry of Motor Vehicles	100 Nashua Street	tunnel under building	-
G.34	Suffolk County Jail	200 Nashua Street	100	-
G.35	Spaulding Rehabilitation Hospital	125 Nashua Street	60	-
H.38	Northern Terminal Warehouse	North Point/Boston and Maine Railroad Yard	-	-
Viaduct Construction				
G.12	Future Boston Garden	88-118 Causeway Street	-	65
G.33	Registry of Motor Vehicles	100 Nashua Street	-	110
H.38	Northern Terminal Warehouse	North Point/Boston and Maine Railroad Yard	55	20
G.42	Northern Terminal Warehouse	North Point/Boston and Maine Railroad Yard	40	25
O.43	Northern Terminal Warehouse	North Point/Boston and Maine Railroad Yard	70	60
G.49	Bunker Hill Community College	Rutherford Avenue	100	100

Source: Bechtel/Parsons Brinckerhoff

* Buildings within 110 feet of construction are potentially affected by construction vibration

Table 5.5

TEMPORARY IMPACTS TO STATE WETLAND RESOURCE AREAS

	Preferred Alternative	Scheme Z[1]
Charles River		
Bordering vegetated wetland (acres)[1]	n/a	n/a
Banks (linear feet)	75	100
Land under water (acres)	0.14	0.4
Land subject to flooding (cf)[2]	120	700
Millers River		
Bordering vegetated wetland (acres)[3]	0	0
Banks (linear feet)	30	110
Land under water (acres)	0.2	0.1
Land subject to flooding (cf)[4]	530	300

1. Impacts to this resource from construction activities result in a permanent loss and are included in Table 2.
2. Presumption of significance for this resource area do not apply. These quantities represent a "theoretical" flood storage volume only.
3. Impacts to this resource from construction activities result in a permanent loss and are included in Table 2.
4 Presumption of significance for this resource area do not apply. These quantities represent a "theoretical" flood storage volume only.

Source:Bechtel/Parsons Brinckerhoff

Table 5.6

TEMPORARY IMPACTS TO FEDERAL WETLAND RESOURCE AREAS

	Preferred Alternative	Scheme Z[1]
Charles River		
nontidal water (acres)	0.40	0.14
wetlands (acres)	0.00	0.00
Millers River		
nontidal water (acres)	0.10	0.20
wetlands (acres)	0.01	0.04

1. The impacts have been recalculated to reflect current pier dimensions and construction methods for the Millers River, thus differing from those included in the 1991 FSEIS/R.

Source:Bechtel/Parsons Brinckerhoff

5.10.2(b) Filled Tidelands

Construction-related temporary impacts to filled tidelands occur as the result of construction of surface roads, viaducts, and cut-and-cover tunnels; relocation and installation of utilities; and demolition and underpinning of various structures. Scheme Z and the Preferred Alternative require the demolition of the existing I-93 bridge over the Charles River, and the Preferred Alternative removes existing CANA ramp stubs C-L and T-C, as a result of redesign. The Preferred Alternative requires the construction of a ventilation building south of the Charles River.

Vehicular access to the MDC facilities, including the Harbor Police, the MBTA bascule bridge, and MDC Gridley Locks and Dam will be maintained. However, all other areas of the Charles and Millers Rivers within the limits of construction will be closed to pedestrians and motor vehicles for public safety reasons.

Summary. The Preferred Alternative and Scheme Z cause temporary impacts due to the construction of piers in flowed tidelands and various structures in filled tidelands.

5.10.3 Navigation

Temporary impacts to navigation in the Charles River are similar for the Preferred Alternative and Scheme Z. Bridge construction will be coordinated to minimize impacts to navigation in the Charles River. Navigation plans and blasting plans (if necessary) will be prepared to detail the schedule and methods employed to minimize impacts on both recreational and commercial traffic. These plans will be submitted to regulatory agencies and the appropriate community for review.

MHD will coordinate with the U.S. Coast Guard and the MDC in further development of construction planning. Permanent navigation impacts are described in Section 4.5.3.

5.10.3(a) Impacts Related To Bridge Construction

The period for bridge construction is estimated to be 4 years. The first phase entails dredging, cofferdam construction, and the pouring of concrete for two approximately 60-foot by 60-foot footings located partially in the water on the north and south banks of the river, for main bridge and pier construction. The southern cofferdam extends into the waterway 40 feet beyond the fender pier line, requiring the temporary removal of approximately 100 feet of fender line. This could result in the temporary closure of the southernmost recreational lock for brief periods during construction. Cofferdam construction of the northern pier intrudes 40 feet into the waterway but remains behind the fender pier line, not intruding into the railroad bascule bridge channel. Commercial and recreational traffic is maintained through the remaining locks and through the bascule bridge during bridge pier construction. Construction of the second bridge also involves the placement of two piers which require pouring concrete for 2 25-foot by 50 foot footings.

Once the bridge piers are completed, construction of the deck span begins. This work may be constructed from equipment mounted on the bridge structure or from equipment secured to barges located in the water. If the bridge is erected from below, two barges capable of supporting 300-ton cranes are required for the construction of the bridge superstructure. These barges typically measure 90 feet by 120 feet. A smaller barge measuring 30 feet by 90 feet supplies the steel spans that form the deck. During the lifts of the deck spans, the flow of commercial and recreational boat traffic through the locks may be curtailed because of construction in and over the waterway. Although each lift may take up to 6 hours, positioning the equipment in the waterway may take a day's time, making it inefficient to move the equipment out after each lift. Therefore, the navigation plan will address the most efficient method of constructing the deck span with the least impact on navigation.

Even if smaller barges, which do not obstruct the waterway, prove capable of sustaining the crane loads, temporary closure of the waterway will be needed during lifts over the navigation channel for safety reasons. All temporary closures would be closely coordinated with the USCG, the MDC, the Harbormaster, and the boating community.

As final design proceeds and more is known about bridge fabrication, the best available technique for bridge construction will be identified. The goal for this construction is to keep the Charles River channel open for navigation to the fullest extent possible.

After the deck spans are installed, finish work on the bridge entails cable fastening, riveting, welding, surface paving, installation of guard rails, and painting. Netting is strung immediately under the deck to contain all materials without compromising vertical clearances. Although construction design and coordination generally allows boat traffic to proceed throughout the period of bridge finish work, there may be instances in which caution dictates temporary closure. Again, these closures will be scheduled to minimize impacts on the boating community. Details of seasonal accommodations, methods of vessel traffic management, overall safety measures, and the coordination with public agencies will be stated in the navigation plan.

Construction period planning will consider the entire navigational system between the Longfellow Bridge and the MDC locks. Currently this system includes boat holding areas on either side of the bascule bridge; however, during certain construction phases the holding area between the bascule bridge and the MDC locks will be unavailable. For the Preferred Alternative and Scheme Z boats will be held upriver of the bascule bridge. Boats will be guided through the construction area. Specific details of accommodating recreational and commercial boat traffic will be discussed in the navigation plan, and will be reviewed by all relevant agencies.

Summary. Overall, the temporary impacts of the Preferred Alternative and Scheme Z are similar. Construction activities in the area will be performed to minimize impacts to navigation.

5.10.4 Fisheries

The severity of temporary impacts to the fisheries during construction depends largely on the methods used (see Section 5.1, Construction Plan), and any additional steps taken to minimize associated impacts (i.e., mitigation). Construction is expected to have limited, localized effects on the Charles River fisheries for the Preferred Alternative and Scheme Z assuming proper controls are implemented. No effects to fisheries are expected in the Millers River, as this river does not sustain fish or their forage.

The methods proposed for bridge construction address major sources of suspended solids (see Section 5.1.1). Suspended solids could affect the survivorship of larval fish which may not attain adequate nutrition while feeding on non-algal sediment. Because of the low flow and controlled depth of the Charles River, a sheet pile arrangement (vertical excavation support) or silt curtains would be effective in controlling the dispersion of suspended solids from dredging, or from shoreline construction areas. Therefore, only minimal temporary impacts are expected during construction of the Preferred Alternative and Scheme Z. By controlling turbidity, fish movement would not be impeded, and would be restricted only from pier construction areas. Because construction is planned so as not to prohibit navigation, it is expected that fish (including anadromous species) passage would not be affected by either alternative.

The Preferred Alternative may require blasting operations to construct the piers. The Charles River Dam pool does not have the high flow rates which aid in dissipating underwater blast energy. The low flow in the Charles River will require implementation of stringent controls necessary to protect the diversity of fish found there year-round. Unlike the anadromous herring that were startled from blast areas by high frequency sound during the I-93 Harbor tunnel construction, many of the other fish species have not responded to such protection devices. Other methods, however, have been used to deter fish from entering harmful locations, including behavioral stimuli such as strobe lights, pneumatic hammers, electric fields, and bubble curtains, and physical barriers such as nets, steel mesh, and silt curtains. In association with blasting controls a protection system using one or several measures would be developed to minimize the potential harm to fish. Physical barriers, because they are not species selective, may be the most effective measure to protect all species of the pool above the dam. Depending on overpressures generated by blasting, bubble curtains might be used to dissipate blast energy.

Acceptable dredged material is anticipated to be disposed at the MBDS under the existing USACE permit. MHD, in coordination with USACE, will reinitiate the original Section 7 Consultation in accordance with the Endangered Species Act of 1973 (16 U.S.C. sec. 1531 et seq.) to provide that additional quantities of dredged material can be disposed at the MBDS without affecting endangered or threatened species.

5.10.5 Water Quality

The Preferred Alternative and Scheme Z require bridge and viaduct construction which would result in minimal water quality impacts. Each bridge pier is constructed within a cofferdam which will contain disturbed sediments.

Dredging and filling in the Charles and Millers Rivers for footings and roadways have localized effects on water quality depending on construction technique and mitigation measures used. To minimize the effects, the contractor will monitor water quality on a regular basis and use such turbidity control measures as turbidity curtains, a closed dredge bucket, and cofferdams. Upon completion of construction, levels of suspended particulates and turbidity are expected to return to existing levels.

As identified in the 1991 FSEIS/R, surface runoff and any excavation dewatering discharge to surface waters or reintroduced into the ground is regulated by DEP and EPA to meet water quality standards. The Project's construction NPDES permit requires site-specific plans for controlling and treating discharges. With those appropriate controls in place, either design would meet applicable regulatory requirements.

5.10.6 Other Aquatic Resources

In general, temporary construction impacts on other aquatic resources are not different from those described for permanent impacts in Section 4.5.6. Wildlife impacts are minimal because of the present unsuitability of the area for wildlife. Any temporary loss of floodplain capacity is negligible because the water level in the Charles and Millers Rivers system is controlled by the Charles River Dam, and because the Millers River is such a small downstream tributary of the much larger Charles River system.

There are no differences in coastal zone impacts in either design. A consistency certification statement is submitted to the Massachusetts Coastal Zone Management Agency in conjunction with Federal permits required for the Charles River Crossing (see Appendix E).

6. Summary Of Mitigation Measures For The Preferred Alternative

Chapter 6

SUMMARY OF MITIGATION MEASURES FOR THE PREFERRED ALTERNATIVE

This chapter summarizes the permanent mitigation measures for each impact category described in Chapter 4 and the Final Section 4(f) Evaluation at the end of Part I of this FSEIS/R. Short-term mitigation measures are identified in Chapter 5, Construction Impacts. The purpose of the summary is to provide a coherent list of measures described in more detail elsewhere in this FSEIS/R. Where appropriate, the chapter/section number is provided as reference to more detailed discussion. In addition, it can be used as a reference guide by agencies including MDC, DEP, USACE, and EPA for tracking implementation of these measures.

The chapter begins with the mitigation program for Project impacts to parkland, waterways and wetlands resources in the New Charles River Basin; it has been coordinated with the MDC and DEP in direct response to the EOEA Secretary's directive in the Certificate on the 1993 DSEIR to:

- develop a mitigation package that is appropriate for Project impacts as a whole
- credit mitigation measures under more than one set of regulations or for more than one purpose
- resolve mitigation issues within the remaining MEPA review, and not postpone resolution to the permitting/licensing stage

The chapter concludes with a list of mitigation measures responsive to other impact categories, including those not necessarily related to the parkland, waterways, and wetlands impacts discussed in the New Charles River Basin mitigation program. Together, these measures represent a comprehensive and coordinated mitigation program for the Area North of Causeway Street. This mitigation program is also intended to supersede and replace prior mitigation commitments for the portions of the original CANA project which will never be constructed and for Scheme Z.

6.1 MITIGATION PROGRAM FOR NEW CHARLES RIVER BASIN

Mitigation measures are proposed to reduce the effects of the Preferred Alternative in the Area North of Causeway Street subarea of the Central Artery/Tunnel Project, and to meet the requirements of regulatory interests. Of particular importance are Section 4(f) of the Transportation Act of 1966, which protects parkland and historic resources and other natural resources from use by transportation projects; the Massachusetts wetlands and waterways protection regulations (310 CMR 10.00 and 9.00); and the Federal Clean Water Act (Section 404(b)(1) and Section 10 of the Rivers and Harbors Act.

These mitigation measures assist with implementation of key elements of the MDC parkland master plan for the New Charles River Basin; the MDC is the parkland administrative agency with jurisdiction in the Project area.

In addition, these measures mitigate wetlands and waterways impacts and, wherever possible, serve to mitigate both parkland and water resources impacts simultaneously. Details of the mitigation program for water resources impacts are in Section 4.5.2 of this FSEIS/R. In addition, details of the mitigation program for parklands are in the Final Section 4(f) Evaluation.

6.1.1 Affected Resources

The affected resources include five existing and proposed parklands, eight historic resources, and two aquatic and tidelands resources in the vicinity of the Charles River Crossing . Direct impacts include the placement of Project structures in resource areas, occupying property, or impairing existing functions and values. Proximity impacts are largely the visual impacts of Project structures on the resources.

6.1.2 Objectives Of Mitigation Program

The objective is to develop a fair and adequate mitigation program that satisfies regulatory requirements for Section 4(f) and wetlands and waterways impacts. In addition, the mitigation program is consistent with the

MDC parkland master plan implementation, to the extent possible. An Amendment and Restatement of the Memorandum of Agreement (the 1993 MOA) among EOTC, MHD, and the MDC has been executed by these parties and is appended to the Final Section 4(f) Evaluation at the end of Part I of this FSEIS/R. In the 1993 MOA, performance standards are set forth for various mitigation measures to be undertaken. The purpose of the performance standards, as stated on page 5 of the amended MOA, is as follows:

> "The list of mitigation measures include a series of park improvements, pedestrian connections, and wetlands and waterway mitigation. The Performance Standards establish baseline criteria for implementing the list of Mitigation Measures. The MDC shall use its expertise and experience in parkland design and construction to develop at least the level of improvement described in the Performance Standards, in a manner designed to achieve the greatest possible consistency with the MDC Master Plan."

The 1993 MOA further describes Performance Standards for Parkland and Accessibility (p.6) and for Wetlands and the Water Feature (p.7). A complete list of the mitigation measures are also contained in the MOA, referenced above.

For mitigation measures that are not encompassed in the performance standards or which could require more mitigation as a subsequent permit condition, such as additional fill in the Charles River to expand parkland, MDC has agreed to assume the permitting requirements. The MDC has the flexibility to pursue further parkland enhancements.

A Project mitigation task force was established to recommend a definite program for State agency review. Identification of specific mitigation measures for individual impacts of Project elements was the first step in the process for the task force. In some cases, the task force concluded that mitigation measures in the same location as the direct Project impact would be ineffective. Rather, the focus of the mitigation measures should be their overall effectiveness in the entire New Charles River Basin and this result is given higher priority. For example, mitigation measures adjacent to the degraded Millers River are not recommended on site, since the river will be shaded by Project structures. Rather, a new water feature nearby in the North Point area in full sunlight is proposed to replace lost functions and values of the Millers River. This approach successfully meets both overall regulatory interests and MDC parkland master plan objectives.

The New Charles River Basin mitigation plan has been coordinated with the constituent agencies of the Project's Water Resources Subcommittee. They have concurred that the replacement of aquatic habitat is best served by locating the new water feature in the North Point area, rather than expanding the Millers River. The mitigation program presented here will be further refined during preliminary and final design and reviewed by the WRS agencies.

MDC park planning objectives have been given high priority in selection of mitigation measures. These key objectives include: providing a continuous pedestrian/parkland link between the Esplanade and Boston Harbor, creating large enough parkland areas to achieve recreational utility, and maximizing views of the Charles River.

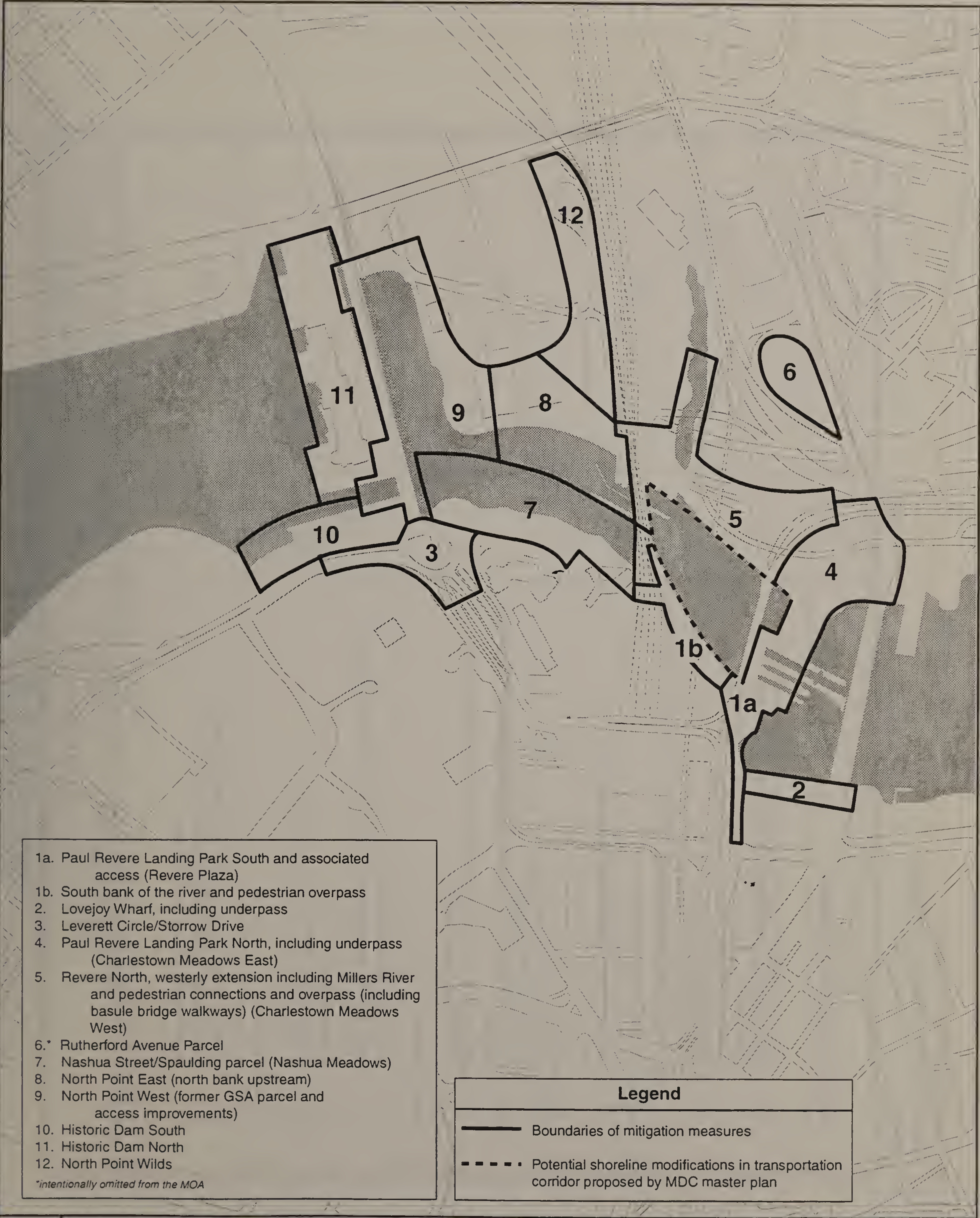
6.1.3 Recommended Mitigation Program

Based on an analysis of the direct and proximity impacts of the Preferred Alternative on these resources, the following mitigation program is recommended for the New Charles River Basin (see Table 6.1; the locations of the mitigation measures are shown on Figure 6.1 with numbers 1 through 12, corresponding to those in Section 6.1.3(a)).

6.1.3(a) Description Of Features Of Mitigation Program

This subsection describes the conceptual development plan for each of the mitigation measures listed in Table 6.1. The descriptions are based generally on MDC's New Charles River Basin Master Plan. The overall goal is to match the quality of development of both recent MDC parkland development and the existing MDC Esplanade upstream of the old Charles River Dam. The specific objective is to provide for continuous walkways and landscaped areas to connect the existing Esplanade and Boston Harborwalk walkways. In addition, a new water feature is included as part of these parkland measures to mitigate for waterways and wetlands impacts. The improvements are described below:

1. **Paul Revere Landing Park South.** This park will become a major entrance to the New Charles



1a. Paul Revere Landing Park South and associated access (Revere Plaza)
1b. South bank of the river and pedestrian overpass
2. Lovejoy Wharf, including underpass
3. Leverett Circle/Storrow Drive
4. Paul Revere Landing Park North, including underpass (Charlestown Meadows East)
5. Revere North, westerly extension including Millers River and pedestrian connections and overpass (including basule bridge walkways) (Charlestown Meadows West)
6.* Rutherford Avenue Parcel
7. Nashua Street/Spaulding parcel (Nashua Meadows)
8. North Point East (north bank upstream)
9. North Point West (former GSA parcel and access improvements)
10. Historic Dam South
11. Historic Dam North
12. North Point Wilds

intentionally omitted from the MOA

Legend

—— Boundaries of mitigation measures

- - - - Potential shoreline modifications in transportation corridor proposed by MDC master plan

FIGURE

6.1

Location of Mitigation Measures

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 800 FEET

Ta[illegible] 6.1

CONCEPTUAL IMPLEMENTATION SCHEDULE, NEW CHARLES RIVER BASIN MITIGATION PROGRAM

Mitigation Measure	Prior To Construction	Construction Year.								
		1	2	3	4	5	6	7	8	
1. Paul Revere Landing Park South										
1.1 Improve park						☐				
1.2 Improve corridor south to Causeway Street					☐					
1.3 Connect riverside walkway to south trestle walkway						☐				
1.4 Provide south bank railroad overpass for pedestrians/bicycles						☐				
2. Lovejoy Wharf Park	◆									
2.1 Acquire wharf property	☐									
2.2 Demolish existing timber wharf and timber piles	☐									
2.3 Reconstruct wharf	☐									
2.4 Improve as park with walkway	☐									
2.5 Provide Lovejoy Wharf/North End Park walkway underpass, with access to North Washington Street bridge	☐									
3. Leverett Circle/Storrow Drive										
3.1 Improve green spaces and edges							☐			
3.2 Provide appropriate architectural treatment to underpass and boat section facades			☐							
3.3 Provide new pedestrian overpass between Leverett Circle/MBTA Science Park station and Nashua Street Park						☐				
4. Paul Revere Landing Park North										
4.1 Improve park	☐									
4.2 Provide Tudor Wharf/Revere North walkway underpass	☐									
5. Revere Park North, Westerly Extension										
5.1 Construct walkway over MBTA railroad tracks to connect with North Point East Park						☐				
5.2 Improve park							☐			
5.3 Provide walkway from Rutherford Avenue to Charles River along east side Millers River								☐		
5.4 Address Millers River stormwater drainage functions, as required*						☐				
5.5 Construct walkways on either side of MBTA bascule bridge, north half								☐		
6. Landscaping of Rutherford Avenue Infield*	☐									

◆ = Events
* Intentionally omitted from the 1994 MOA
Source: Bechtel/Parsons Brinckerhoff

Table 6.1 (Continued)
CONCEPTUAL IMPLEMENTATION SCHEDULE, NEW CHARLES RIVER BASIN MITIGATION PROGRAM

Mitigation Measure	Prior To Construction	Construction Year.							
		1	2	3	4	5	6	7	8
7. Nashua Street Park									
7.1 Improve park	☐								
7.2 Improve waterfront portion of Spaulding Hospital site with minimum 100-foot depth									☐
7.3 Rehabilitate shoreline as necessary	☐								
7.4 Remove pilings from river after consultation with owner	☐								
8. North Point East (park)									
8.1 Acquire land	◆								
8.2 Improve park	☐								
8.3 Remove existing railroad trestle at north riverbank after consultation with owner Rehabilitate shoreline as necessary	☐								
8.4 Remediate contaminated soils as necessary	☐								
8.5 Provide new water feature with vegetated wetlands	☐								
8.6	☐								
9. North Point West (park)									
9.1 Acquire land for relocation of MDC central services facility	◆ ☐								
9.2 Construct new MDC central services facility	☐								
9.3 Demolish existing MDC central services facility	☐								
9.4 Remediate contaminated soils as necessary	☐								
9.5 Improve park	☐								
9.6 Provide new water feature, incorporating vegetated wetlands	☐								
9.7 Improve pedestrian access to North Point Park and Historic Dam North and South.	☐								
10. Historic Dam North									
10.1 Improve area and upgrade associated structures to the extent practicable	☐								☐
11. Historic Dam South									
11.1 Improve area and upgrade associated structures to the extent practicable	☐								☐
12. North Point Wilds									
12.1 Improve area									☐

◆ = Events

Source: Bechtel/Parsons Brinckerhoff

River Basin. Two key pedestrian paths will be provided, and will intersect: one will connect Causeway Street and the Charles River Dam walkway on the locks; the other will connect the existing walkway on the east side of the MBTA trestle and Lovejoy Wharf. This area of nearly 2.1 acres will be landscaped, lighted, and furnished appropriate to its entrance function. A pedestrian bridge will be provided to span the MBTA railroad tracks between the Spaulding parcel and the Paul Revere Landing Park South. The bridge will be appropriately lighted.

2. **Lovejoy Wharf Park**. This 0.8-acre wharf is adjacent to Paul Revere Landing Park South and will include a pedestrian path linking it up to the North Washington Street bridge above and under it to access the North End Waterfront Park. The area will be landscaped, lighted and furnished to the same standards as Paul Revere Landing Park South.

3. **Leverett Circle/Storrow Drive.** Approximately 0.9 acre of green space and roadway edges will be landscaped. The boat section and facade of the new underpass will receive appropriate architectural treatment. As part of the replacement of existing pedestrian overpasses, an extension to the new Nashua Street Park will be provided.

4. **Paul Revere Landing Park North.** This existing park will be enlarged to approximately 4.6 acres in total size and relandscaped to perform a gateway function to the new park system from Charlestown. This incorporates a prior commitment in the Chapter 91 license for the CANA project. New pathways will connect City Square to the dam locks walkway and alongside the Charles River and connect with Tudor Wharf under the North Washington Street bridge. Landscaping, lighting, and furnishings will be of similar character as Paul Revere Landing Park South.

5. **Paul Revere Landing Park North, Westerly Extension, Including Millers River Area.** This linear area of approximately 6.0 acres of new parkland will extend west along the north bank of the Charles River and will include a walkway along its length to a 750-lf pedestrian bridge over the MBTA railroad tracks. The area will be landscaped, lighted, and furnished similar to Revere North (4). A walkway will be provided between Rutherford Avenue and the Charles River. This incorporates a prior commitment in the Chapter 91 license for the CANA project. It will be landscaped and lighted to create a safe and attractive ambience. In addition, complete cross-river passage for pedestrians on 700 lf of walkways will be provided on either side of the north half of the MBTA railroad bascule bridge. They will connect to the existing walkways on the south half of the bridge, which in turn will connect to the riverside walkways on either bank. The bridge walkways will be appropriately lighted and signed, since passage will be interrupted at times when the bascule is in an open position .

6. **Rutherford Avenue Parcel.** An infield parcel approximately 2.0 acres in size along Rutherford Avenue will be landscaped to provide a buffer between Charlestown and Project facilities and structures located behind the parcel. This incorporates a prior commitment in the Chapter 91 license for the CANA project. This measure is independent of the Amended MOA and intentionally omitted from it.

7. **Nashua Street Park.** This linear parcel of approximately 2.6 acres, between Leverett Circle and the MBTA railroad tracks, will include a walkway connecting the Esplanade upstream, via the new pedestrian overpass to be provided at Leverett Circle, to the existing Spaulding walkway. A 0.6-acre area from the northern half of the adjacent Spaulding Hospital site will be added to the Nashua Street Park. It will be at least 100 feet in width from the river. The entire area will be landscaped, lighted, and furnished.

8. **North Point East.** A 2.9-acre linear riverside parcel of land (including new land acquisitions) will be landscaped, lighted, and furnished to provide a pedestrian link between the pedestrian bridge over the MBTA railroad tracks and the remainder of parkland to be developed in this area to the west. This area comprises 2.1 acres plus the area occupied by a portion of a new water feature (described below) and its banks. In addition, existing pilings and a deck of a former railroad trestle at the north riverbank will be removed, subject to consultation with the owner(s).

9. **North Point West.** Riverfront land along the edge of the North Point inlet opposite the historic Street Railway Viaduct and a new 1.2-acre water

feature are the main elements of this park (see Figure 6.2). It will include walkways that will connect the Museum of Science to this park and to North Point East Park. Banks of the water feature will be planted with wetland vegetation. The shoreline will be rehabilitated, if necessary. The entire area, comprising 2.9 acres plus the area of the water feature and its banks, will be landscaped, lighted, and furnished to the standards achieved elsewhere in the New Basin. Prior to development, the existing MDC central services facility will be relocated to another site and access to the park will be improved.

10. Historic Dam North. Public areas at both ends of the Museum of Science as well as the historic stables and boathouse and other structures located at the intersection of Land Boulevard and O'Brien Highway will be upgraded to the extent practicable. The 1.6-acre area will be appropriately landscaped, lighted, and furnished.

11. Historic Dam South. The land area south of the historic lock and the historic MDC buildings located there will be upgraded to the extent practicable. The 3.1-acre area will be appropriately landscaped, lighted, and furnished.

12. North Point Wilds. A 6.3-acre land area between the proposed North Point development and the MBTA railroad right-of-way, expanding north to the Gilmore Bridge, will be improved as a buffer area.

6.1.4 Schedule For Mitigation Program

In response to the Secretary of Environmental Affairs' directive to implement the mitigation measures as early as possible, the following conceptual schedule is proposed (the numbers of each measure are from Table 6.1):

Mitigation Measures Implemented Prior To Construction. These measures can be initiated prior to construction because these locations are not directly affected by construction activities.

Lovejoy Wharf Park (2)
Paul Revere Landing Park North (4)
North Point East (8)
North Point West (9)
Historic Dam North (10)
Historic Dam South (11)
Nashua Street Park, except Spaulding portion (7)

Mitigation Measures Implemented During Construction. These measures can be implemented as certain Project elements are completed. The schedule reflects implementation of measures as early as possible.

Paul Revere Landing Park South (1)
Leverett Circle/Storrow Drive (3)
Revere Park North, westerly extension (5)
Infield parcel on Rutherford Avenue (6) (1994)
Spaulding parcel adjacent to Nashua Street Park (7)
Historic Dam North (10)
Historic Dam South (11)
North Point Wilds (12)

This conceptual implementation schedule for the mitigation measures will be detailed in the subsequent preliminary and final design processes for the Project and in construction specifications for relevant design and construction contracts that also include these measures. Some of the measures are located outside Project construction areas, such as those west of the MBTA bascule bridge. These premainline measures will be the subject of separate contracts.

6.2 OTHER MITIGATION MEASURES

The following is a summary list of mitigation measures by impact category for the Preferred Alternative. Long-term permanent measures are listed first, followed by short-term temporary preventive and other mitigation measures during the construction period. References indicate the appropriate section(s) of this FSEIS/R where more detailed discussion can be found.

6.2.1 Long-Term Mitigation Measures

Transportation.

- Rutherford Avenue Corridor Study. The Preferred Alternative relocates the C-L off-ramp from Bunker Hill Community College (as described in the 1993 DSEIS/R) to Cambridge Street, southwest of Sullivan Square, to reduce the adverse traffic impacts to City Square. This design refinement, as well as the other proposed ramps in Charlestown, will alter traffic circulation patterns in Sullivan Square and along Rutherford Avenue. This provides the op-

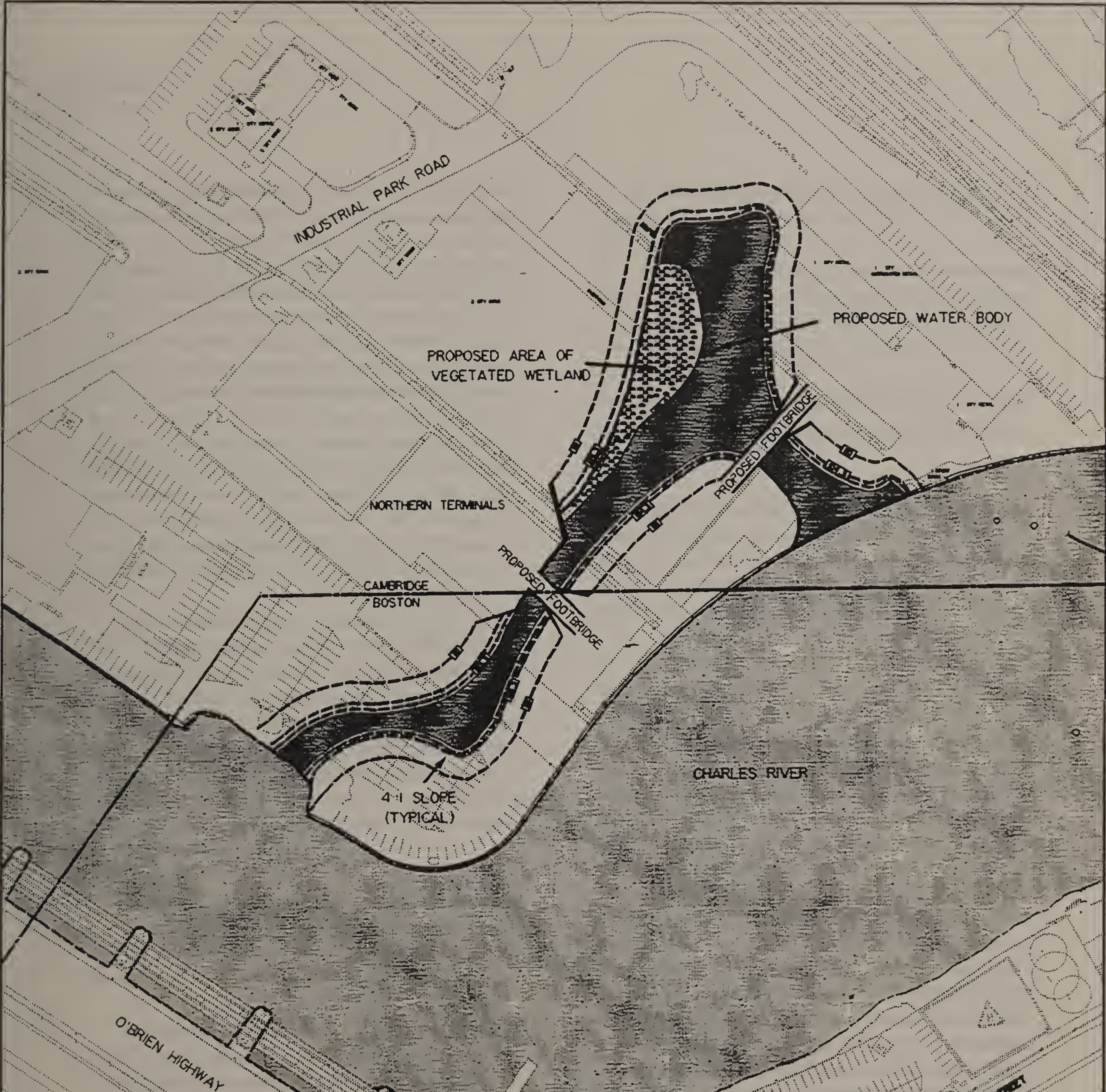

INDUSTRIAL PARK ROAD
PROPOSED WATER BODY
PROPOSED AREA OF VEGETATED WETLAND
PROPOSED FOOTBRIDGE
NORTHERN TERMINALS
PROPOSED FOOTBRIDGE
CAMBRIDGE
BOSTON
4:1 SLOPE (TYPICAL)
CHARLES RIVER
O'BRIEN HIGHWAY
NASHUA STREET
LEVERETT CIRCLE

FIGURE 6.2

Proposed Water Feature (conceptual)

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

portunity to reevaluate the function of Rutherford Avenue in relation to the local and regional highway system. Accordingly, MHD commits to fund an intermodal study of Rutherford Avenue from City Square to and including Sullivan Square. This study will be conducted in cooperation with the BTD, MBTA, and other affected transportation agencies, and it will include, but not be limited to, an evaluation of all planned transportation projects affecting the study area including the proposed Medford Street Bypass Road, and other planned improvements to the Rutherford Avenue/Sullivan Square viaduct and tunnel structures. Upon completion of the study MHD will assign high priority to and advance the implementation of appropriate capital improvements consistent with Statewide and regional planning.

- Replacement Parking. The MBTA's 1,300-space North Station parking garage replaces all publicly owned spaces permanently lost as a result of the Project. Owners of displaced private spaces are to be compensated for their loss. No net loss will occur to on street parking spaces, public/private transit loading and staging spaces, and commercial loading spaces. MHD will continue to work with the BTD to identify appropriate replacement strategies for these spaces.

- Pedestrian Paths and Bikeways. Pedestrian paths and bikeways will be installed as part of the MDC's parkland master plan for the Lower Charles River Basin.

- Geometric Modifications. Appropriate operational and/or geometric modifications will be made to the following intersections to offset degradation to LOS resulting from the Project: Leverett Circle; New Sudbury/Cross Streets; Charles Circle; Keany Square; and Sullivan Square.

See Section 4.1 for details on long-term transportation mitigation measures.

Land Use.

- Open space impacts are mitigated through the comprehensive mitigation program for the New Charles River Basin (6.1.3(a)).

- No mitigation measures are necessary for wind impacts on pedestrianways (4.2.2(a)).

- All relocations are carried out in accordance with Public Law 91-646, as amended, and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (4.2.3(b)).

- An early acquisition of the Spaulding Rehabilitation Hospital will be made to facilitate an orderly relocation (4.2.3(b)).

- Mitigation for the taking of the Boston Thermal Energy Corporation's Minot Station steam generating plant includes funding a functional replacement study, compensation for acquisition of the property and relocation assistance (5.7.1).

- No mitigation measures are necessary for economic impacts (4.2.4).

- The design and location of Project elements on affected parcels minimize adverse impacts to joint development potentials (4.2.5(e)). The ventilation building is sited at the southern end of the Nashua Street parcel and built mostly below ground, although stacks will extend above grade. The parcel can be expanded at the northern end to incorporate the southern half of the Spaulding Hospital site. The MBTA air rights garage parcel could possibly be consolidated with the adjacent Nashua Street parcel. A 100-foot-wide strip of the northern portion of the Spaulding site can be annexed to the MDC Nashua Street Park site and developed as parkland. The Lomasney Way air rights parcel, over a highway corridor, has been designed to accommodate development above it as well as pedestrian connections across it. The Rutherford Avenue parcel will be landscaped and contoured to screen Project facilities from the Charlestown neighborhood.

Air Quality.

- No mitigation measures are necessary for air pollutants from mobile sources (i.e., from traffic operations) (4.3.6). Such mitigation has already been incorporated into ramp design and traffic signal timing through coordination between the traffic and air quality prediction methodologies used in preparation of this FSEIS/R.

- No mitigation measures are necessary for emissions from ventilation stacks.

Noise And Vibration.

- A noise barrier is recommended at one location: a 1,240-foot-long, 14-foot-tall barrier at Bunker Hill Community College.

- No long-term mitigation measures are necessary for operational vibration impacts since standards are met (4.4.2).

Aquatic Impacts.

- Wetlands mitigation is implemented via the comprehensive mitigation program for the New Charles River Basin (6.1.3(a)). Specific wetlands mitigation meets performance standards in the previously referenced 1993 MOA in Section 6.1.2 by incorporating several features. These features include a minimum of 9,500 sf of vegetated wetlands (with appropriate plant species), located between elevations 101.0 and 103.5 (Project datum), of which 4,000 sf is located between elevation 102.4 and 103.5. It may be composed of two or more areas, but each area must have a minimum of 4,000 sf. The area will be hydraulically connected to the Charles River, portions of which will be located in Boston and Cambridge. Soils will be of a suitable substrate for establishment of wetland vegetation.

- Waterways mitigation will meet the 1993 MOA performance standards. The mitigation program will include 1.2 acres of contiguous watersheet at elevation 102.4, which will provide 43,000 cubic feet (cf) of flood storage volume between elevation 103.5 and 104.3. This watersheet will be navigable by small watercraft and connect to the Charles River in two places. In addition, it will have sufficient flow to prevent stagnation, and sufficient depth to inhibit growth of vegetation on the bottom which would interfere with navigation. Portions of this area will be located in Boston and Cambridge. Other mitigation to tidelands is described in Section 4.5.3, Proposed Waterways Mitigation.

- Navigation mitigation includes implementing those measures from the 1991 FSEIS/R, repeated here (4.5.3):

  - Navigation and lighting aids will be located in coordination with the MDC and the USCG.

  - Retaining walls, fender piers, and dolphins will be rehabilitated if affected by Project construction activities.

  - A pier fendering system will be provided for all new piers.

  - Existing I-93 bridge piers will be removed except for the banana pier which will be marked with navigational aids.

  - Vertical clearances of 23 feet for recreational locks and 30 feet for the commercial lock will be maintained.

  - The Charles River piers will be placed to allow passage of a 300-foot barge.

  - All bridge piers will be placed outside of the line of navigation, in line with existing fenders wherever possible.

  - A CADD model study will be used to study the view from several locations to provide for maintenance of the view of dam operators.

  - If necessary, closed-circuit TV monitors will be provided to dam operators.

  - The Crossing will not impede the right of access by water to adjacent property owners' land.

- For the reasons set forth in Sections 4.5.4 and 4.5.6, no long-term mitigation measures are necessary for impacts to other aquatic resources including wildlife, wild and scenic rivers, coastal barriers and coastal zone.

Threatened or Endangered Species.

- No mitigation measures are necessary for threatened or endangered species since there are none in the area.

Historic And Archaeological Resources.

- Mitigation measures for three historic resources follow (4.7.1(d)). Specifications for design and construction of this work will be reviewed by the Project Conservator, the SHPO, and local historic agencies, in accordance with Stipulation 4 of the 1984 MOA: (1) Any portion of the granite seawalls in the lower basin of the Charles River will be disassembled and rebuilt with existing materials, or in-kind, to match existing conditions. Stipulation 2 of the 1984 MOA provides analogous design guidelines. Further design studies for the new water feature will determine specific impacts to the seawall. (2) The Registry building will be underpinned for construction of a tunnel underneath it and portion of the facade of the building will be stabilized or restored with in-kind materials as necessary. Visual impacts of the nearby ventilation stacks on the Registry building will be reviewed by the Conservator, the SHPO, and BLC. Joint development guidelines for this area will include preservation criteria to enhance the integrity of the building. (3) Resurfacing of Stillman Place in the North End Historic District will reuse or replace in-kind the existing granite paving blocks and bollards which are disturbed by Project construction. The Secretary of the Interior's "Standards For The Treatment Of Historic Properties" will be used.

- Mitigation measures for archaeological resources includes monitoring of geotechnical borings for the piles of the two elevated collector/distributor roads north of the Gilmore Bridge and the I-93 off-ramp to Cambridge Street near Sullivan Square. Work will include research, field investigations, laboratory analysis, conservation of fragile specimens, report preparation, and recommendations for further study, if warranted (4.7.2(f)).

Hazardous Waste Sites.

- No mitigation measures are necessary for hazardous waste sites (4.8) since none has been identified in the Project subarea.

Visual Impacts.

- Mitigation measures include the following: providing for compatibility of the design of highway elements and Project-related buildings with the proposed parkland, surface roads, open space, and surrounding neighborhood activity; integrating the Artery Arts Program with the design of the Project and new parkland; designing high quality bridges in keeping with its visually prominent location; and designing landscape and architectural elements to screen undesirable views, achieve a coherent visual environment, and make visual connections with the surroundings (4.9.3).

Energy.

- No mitigation measures are necessary for energy impacts.

6.2.2 Construction Mitigation Measures

Please refer to Chapter 5.

7. Comments And Coordination Since The 1993 DSEIS/R

Chapter 7
COMMENTS AND COORDINATION

7.1 INTRODUCTION

The DSEIS/R for the Charles River Crossing was filed July 30, 1993, with the Environmental Protection Agency and the Massachusetts EOEA. The general public was offered the opportunity to review and comment on the DSEIS/R during FHWA and Massachusetts Environmental Policy Act public review processes from August 6 to October 5, 1993. These processes included a public hearing, a public comment period, and continuation of the public participation program through three separate community meetings held in September 1993 in East Cambridge, Charlestown, and the North Station area.

A synopsis of the most frequent comments raised during the public review period is presented in Section 7.3. Many of the comments during the public review process expressed a design preference or raised issues relating to criteria for the identification of a Preferred Alternative. These comments were analyzed and considered as an integral part of the process for identifying the Preferred Alternative, as documented in detail in Chapter 2. The letters and responses to them are published in the Appendix in Part II of this FSEIS/R.

7.1.1 Public Hearing For Offering Of Testimony

The Public Hearing was held on September 14, 1993, at the Boston Museum of Science Auditorium from 9:00 AM to 9:00 PM. Statements were made by 40 speakers and testimony was provided by 17 commenters, some of whom were also speakers. Copies of the hearing transcript have been available for review by the public at public and agency libraries since shortly after the hearing. An index of all hearing commenters is provided in Section 7.2.1. Oral and written testimony are summarized in Sections 7.4.2 and 7.4.3, respectively.

Public Review Of The Draft SEIS/R. The DSEIS/R was made available for review at the following locations:

Central Artery/Tunnel Project
One South Station
Boston, MA

Brookline Public Library

Cambridge Public Libraries
    Main Library
    Boudreau/Observatory Hill
    Central Square
    Collins/Mt. Auburn
    Heritage Branch
    North Cambridge

Boston City Hall
    Department of Transportation
    Boston Redevelopment Authority

Federal Highway Administration
55 Broadway
Cambridge, MA

State Transportation Library
10 Park Plaza
Boston, MA

Massachusetts Institute of Technology,
Rotch Library, Cambridge

State House Library

Boston Public Libraries
    Main Branch-Boylston Street
    Charlestown
    East Boston
    Orient Heights
    North End
    South End
    West End
    South Boston
    Valente

Chelsea Public Library

Concord Public Library

Malden Public Library

Revere Public Library

Somerville Public Library

Winthrop Public Library

7.1.2 Comment Period For Submission Of Letters

The public comment period began August 6, 1993, and ended October 5, 1993, including an extension from the traditional 45 days to 65 days for NEPA, and from 37 days to 61 days for MEPA. During the public comment period, MHD received 91 letters regarding the DSEIS/R. An index of all letters received is provided in Section 7.2.2. Letters are reproduced and responses to substantive comments raised are provided in Part II of this FSEIS/R.

7.1.3 Public Participation Program

MHD has continued to actively solicit public involvement since the DSEIS/R was published. The public participation, agency liaison, and public information components of the public participation program are described in the following sections. All of these components were used during the DSEIS/R comment period to focus public attention on the availability of the document, the opportunity of attending the Public Hearing, and the willingness of MHD to clarify issues and provide supplementary information through publications, exhibits, and meetings, at the Project office at South Station, Boston, Massachusetts.

7.1.3(a) Notice Of Availability Of DSEIS/R

Public notice of the availability of the DSEIS/R was provided by the following means:

- Publication in the *Federal Register*, Volume 58, No. 150, dated August 6, 1993.
- Publication in the *Environmental Monitor* of the Executive Office of Environmental Affairs, dated August 10, 1993.

7.1.3(b) Notice Of Public Hearing

Public notice of the scheduling of a joint Public Hearing of the USACE, FHWA, and MHD to solicit public comments on the Charles River Crossing DSEIS/R was provided by the following means:

- Publication of a legal Public Notice in area newspapers during the week of August 8, 1993.
- Publication of Public Hearing Announcements in various newspapers from September 9th through the 12th, 1993.
- Mailing of Public Hearing notices.
- Mailing of Public Hearing notices to all property owners whom the Project will affect.

7.1.3(c) Handling Of Comments Received In Testimony And Letters

Letters and testimony were coded with letter and consecutive comment numbers and distributed at regular intervals to Project technical staff. The comments and responses were maintained in a computer database to track issues and their resolutions.

7.2 INDEX OF COMMENTERS

7.2.1 Public Hearing Testimony

All oral testimony received during the Public Hearing has been summarized in this volume. The following is an index of commenters, grouped by category. The entries identify whether the testimony was oral, written or both. The summarized testimony is provided in Section 7.4 in the order in which it was received.

7.2.1(a) Federal Agencies

Organization	Commenter	Oral/Written
none		

7.2.1(b) State Agencies

Organization	Commenter	Oral/Written
Bunker Hill Community College	C. Sculley Stikes	oral/written

7.2.1(c) Local Agencies

Organization	Commenter	Oral/Written
Boston Environment Department	Lorraine Downey	oral/written
Boston Transportation Department	Rina Cutler	oral/written
Cambridge Conservation Commission	Alex Strysky	oral/written
Cambridge Environmental Program	Elizabeth Epstein	oral/written
Cambridge Planning Board	Paul Dietrich	oral/written
Cambridge Traffic Department	Lauren Preston	oral/written

7.2.1(d) Public Interest Groups

Organization	Commenter	Oral/Written
Artery Business Committee	Robert Brannen	oral
	Stanley Miller	oral
	William Coughlin	oral
	Harold Hestnes	oral
	John Thompson	oral
Beacon Hill Civic Association	Peter Thomson	oral/written
Boston Artery Focus Group	Robert O'Brien	oral/written
	Anthony Pangaro	oral/written
Bridge Design Review Committee	Stanley Miller	oral
Cambridge Citizens for Livable Neighborhoods	Daniel Geer	oral
Cambridge Street Community Development Corporation/Beacon Hill Civic Association	Joseph Hinckle	oral
Citizens for a Liveable Cambridge	Daniel King	oral
Conservation Law Foundation	Paul Hauge	oral

Organization	Commenter	Oral/Written
Charlestown Preservation Society	Rosemary Kverek	oral
North Area Task Force	Kenneth Stone	oral
Massachusetts Laborers District Council	Paul McNally	oral
Massachusetts 2000	Ann Donner	oral/written
National Trust for Historic Preservation	Vicki Sandstead	oral
Sierra Club	Gilbert Woolley	oral/written

7.2.1(e) Private Organizations/Individuals

Organization/Individual	Commenter	Oral/Written
Stanley Durlacher		oral
Liberty Bell Wholesale Grocery Company	Robert Borzakian	oral
Life Focus Center	James Conway	oral
Museum of Science	David Ellis	oral
North Point Limited Partnership	Dean Stratouly	oral/written
North Shore Realty Trust	Gerard Gillis	oral
Boston Resident	Keith Davison	written
Beverly Resident	James Rose	oral/written
Cambridge Resident	Kathryn Erat	oral
Cambridge Resident	Stephen Kaiser	oral/written
Cambridge Resident	Susan Perry	oral
Charlestown Resident	Donald Haska	oral
Charlestown Resident	William Kuttner	oral
Charlestown Resident	Elaine McCarthy	oral
Melrose Resident	Joseph Millette	oral/written
Planning Consultant	Michael Bernard	oral

7.2.2 LETTERS

All letters received during the public comment period are included in the Appendix of this FSEIS/R. The following is an index of commenters, grouped by category.

7.2.2(a) Federal Agencies

Letter	Organization	Date
F-1	Department of the Interior, Fish and Wildlife Service, New England Office	09/23/93
F-2	Environmental Protection Agency, Region I	10/05/93
F-3	Department of the Army, New England Division, Corps of Engineers	(rec'd.) 10/05/93
F-4	Department of the Army, New England Division, Corps of Engineers (letter transmitting comments received on permit application)	10/12/93
F-5	Department of Transportation, Federal Transit Administration, Region I	(rec'd.) 10/08/93
F-6	Department of the Interior, Office of the Secretary	(rec'd.) 10/04/93
F-7	Department of Commerce, National Oceanic and Atmospheric Administration National Marine Fisheries Service	10/01/93
F-8	General Services Administration	10/04/93

7.2.2(b) State Agencies

Letter	Organization	
S-1	House of Representatives, Richard Voke	09/15/93
S-2	Senate, Robert E. Travaglini	10/01/93
S-3	Massachusetts Bay Transportation Authority	10/05/93
S-4	Division of Capital Planning and Operations	10/05/93
S-5	Division of Marine Fisheries	10/05/93
S-6	Legislative Central Artery Rail Link Caucus	10/05/93
S-7	Coastal Zone Management	10/04/93
S-8	Department of Environmental Protection	10/05/93
S-9	Metropolitan District Commission	10/05/93
S-10	Massachusetts Turnpike Authority	10/05/93
S-11	Senate, Thomas F. Birmingham	10/05/93
S-12	Bunker Hill Community College	10/05/93

7.2.2(c) Local Agencies

Letter	Organization	Date
L-1	Boston Water and Sewer Commission	08/31/93
L-2	Boston Fire Department	09/01/93
L-3	Boston Landmarks Commission	10/05/93
L-4	Boston Environment Department	10/05/93
L-5	Cambridge, City of, City Manager (includes 3 enclosures)	
	Conservation Commission (letter)	10/05/93
	Planning Board (letter)	09/30/93
	City Council Amended Order 64	09/13/93
L-6	Boston Transportation Department	10/05/93

L-7	Boston Redevelopment Authority	10/05/93
L-8	City of Somerville, Michael E. Capuano, Mayor	10/05/93

7.2.2(d) Public Interest Groups

Letter	Organization	Date
P-1	Save the Harbor, Save the Bay	09/14/93
P-2	Boston Greenspace Alliance	09/24/93
P-3	Massachusetts Association of Conservation Commissions	09/27/93
P-4	Citizens Transportation Action Campaign	09/26/93
P-5	Bridge Design Review Committee	09/30/93
P-6	Life Focus Center, Inc.	10/02/93
P-7	Citizens for a Livable Charlestown	10/04/93
P-8	Cambridge Citizens for Livable Neighborhoods	10/04/93
P-9	Bunker Hill Monument Association	10/04/93
P-10	Charlestown Preservation Society	10/04/93
P-11	Boston Area Bicycle Coalition	10/04/93
P-12	Central Artery Oversight Committee	10/04/93
P-13	Cambridge Street Community Development Corporation (includes 11/27/91 letter previously sent)	10/05/93
P-14	Charles River Watershed Association	10/04/93
P-15	Charlestown North Area Task Force (includes copy of oral testimony delivered 10/14/93)	10/05/93
P-16	Charlestown Neighborhood Council	10/05/93
P-17	Downtown North Association (Boston Artery Focus Group) (includes copy of letter dated 11/23/92, previously sent)	10/05/93
P-18	1000 Friends of Massachusetts	10/05/93
P-19	Artery Business Committee	10/05/93
P-20	Conservation Law Foundation	10/04/93
P-21	National Trust for Historic Preservation	10/05/93
P-22	Sierra Club	10/05/93
P-23	Beacon Hill Civic Association	10/04/93
P-24	Massachusetts Audubon Society	10/05/93
P-25	Boston Harbor Association	10/05/93
P-26	Art Deco Society of Boston	10/01/93
P-27	ASERT	10/01/93

7.2.2(e) Private Organizations/Individuals

Letter	Organization/Individual	Date
I-1	Stephen H. Kaiser	08/05/93
I-2	Stephen H. Kaiser	08/06/93
I-3	Keith K. Davison (errata)	08/24/93
I-4	Keith K. Davison	09/01/93
I-5	Prins Recycling Center	09/15/93
I-6	Rose and Tony D'Ambrosio	09/16/93
I-7	Caravan for Commuters	09/17/93
I-8	First Properties, Inc.	09/18/93

I-9	Liberty Bell Wholesale Grocery Co. Inc.	09/11/93
I-10	Don Haska	09/17/93
I-11	Peter Roudebush and Associates	09/27/93
I-12	Keith Davison (includes 9/14/93 letter and "notes")	09/29/93
I-13	New Boston Garden Corporation	09/30/93
I-14	Dorothy E. Conway	10/01/93
I-15	*Charlestown Patriot*, Gloria S. Conway, Publisher and Managing Editor	10/01/93
I-16	Eleanor S. Jaffe (2 letters)	10/01/93
I-17	Charles Bahne, Jr.	10/01/93
I-18	Rosemary Kverek	10/04/93
I-19	Michael Travaglini	10/04/93
I-20	Massachusetts General Hospital	10/04/93
I-21	Martin E. Iorns	10/04/93
I-22	Harvard University Graduate School of Design (Spiro Pollalis)	10/04/93
I-23	Malcolm M. Davis	10/04/93
I-24	Casendino and Company	10/05/93
I-25	Anthony Pangaro (includes 11/27/92 letter on behalf of Beacon Hill Civic Association)	10/05/93
I-26	Boston Society of Landscape Architects	10/05/93
I-27	Rappaport and Rakov for Whittier Place Condominium Trust (including 9/29/93 letter from Rizzo Associates, Inc.)	10/05/93
I-28	Charles River Publishing	10/05/93
I-29	G. Conway Inc.	10/05/93
I-30	Brad Bellows	10/05/93
I-31	Stephen Kaiser	10/05/93
I-32	Ivey St. John	10/04/93
I-33	Jeff Perk	09/30/93
I-34	Boston Edison	(rec'd.) 10/18/93

7.3 RESPONSES TO COMMENTS FREQUENTLY RAISED

The following is a summary of the key comments on the DSEIS/R for the Charles River Crossing raised in the hearing testimony and the letters.

The section is organized by subject. In each subsection, a summary of comments and issues raised most frequently on the DSEIS/R is provided. This is followed by a summary of the response and reference to the section in the FSEIS/R where more details can be found.

7.3.1 Design Alternatives

Selection Process.
Comments: The agency commenters with jurisdiction over environmental issues such as the USACE, Massachusetts DEP, and others generally indicated that all three new design alternatives were an improvement over Scheme Z.

Response: MHD has conducted analyses of more than 80 design alternatives on the Area North of Causeway Street since 1986. As presented in the DSEIS/R the three new design alternatives present substantial improvements to Scheme Z (see Section 2.3.1).

Design Preferences.
Comments: Charlestown and Cambridge local agencies, public interest groups, businesses and residents reinforced their opposition to Scheme Z and strongly indicated their preference for Alternative 8.1D Mod 5. In support of this preference, the Bridge Design Review Committee urged that MHD consider that the long-term benefits of 8.1D Mod 5 outweighed the greater environmental short-term impacts associated with tunnel construction. The long-term improvements they cited include: a narrow 10-lane bridge; a 200-foot setback of infrastructure from the north bank of the Charles River, opening up the area for MDC park development; and a single loop ramp west of Rutherford Avenue.

Acknowledging severe design deficiencies of Alternative 8.1D Mod 5 some of the commenters in support of this alternative requested further design refinements, specifically the inclusion of two ventilation buildings and redesign of the Leverett Circle area to address the failed traffic condition.

Response: As explained in the 1992 NPC and 1993 DSEIS/R, Alternative 8.1D Mod 5 represents a substantial improvement to Scheme Z, in terms of aesthetic impacts to the lower Charles River Basin and to the abutting communities. The marginal aesthetic improvement as compared to the Preferred Alternative, however, is outweighed by safer and more efficient highway and street operations, avoidance of certain protected resource areas, the substantially shorter construction duration, and the opportunity for substantially earlier park development associated with the Preferred Alternative (See Section 2.4.3).

MHD investigated design refinements to the Leverett Circle area in coordination with BTD. It was concluded that the refinements would maintain many of the negative aspects of Alternative 8.1D Mod 5. These include the following: Reducing operational safety; and, increasing environmental consequences, such as the necessity to acquire a portion of the Nashua Street parcel, and the acquisition and demolition of the Registry building, which are both protected 4(f) resources. Despite the traffic improvements at Lowell Square and Leverett Circle, the operations of the newly formed Nashua Street on-ramp/intersection would be unacceptable (See Section 2.4.3(c)).

Comments: There was some support for the Reduced River-Tunnel Alternative, if Alternative 8.1D Mod 5 failed. There was also some support of the Non-River-Tunnel from sponsors of a housing and mixed-use development directly affected by 8.1D Mod 5 and from some Boston business groups.

BTD, supported by residents of Boston in the vicinity of Beacon Hill, requested that a revision of the Reduced River-Tunnel Alternative be considered that placed the river tunnel in the transportation corridor between the Charles River Dam and the MBTA bascule bridge. The Federal Transit Administration indicated its concern that this design refinement could possibly preclude the construction of the North Station/South Station Rail Link.

Response: MHD considered the Reduced River-Tunnel Alternative and the refinement known as the Realigned Reduced River-Tunnel Alternative. See Section 2.2.4 for a detailed discussion of the implications of this Alternative and realigned refinement.

Comments: A few commenters questioned why a mainline tunnel alternative was not considered.

Response: A mainline tunnel alternative was studied prior to the 1986 FEIS/R. In addition, this alternative was presented to the Bridge Design Review Committee (BDRC) and was subsequently rejected due to conflicts with the MBTA Orange Line tunnel beneath the Charles River, and physical constraints of connecting to the existing I-93 viaduct on the north bank of the river.

7.3.2 Design Refinements

Several commenters identified deficiencies in all of the new design alternatives. In response, MHD conducted design refinement analyses following the publication of the DSEIS/R to address these concerns. Some of the refinements are common to all of the alternatives and some are specific to only one or two of the alternatives. What follow are comments and responses on design features.

Ramp C-L.
Comments: Under all three design alternatives the local off-ramp from I-93 northbound to Charlestown at Rutherford Avenue was located just south of A Street within Bunker Hill Community College athletic fields. Bunker Hill Community College, residents, and businesses in the vicinity of the college indicated strong opposition to the Ramp C-L location during the Public Hearing and in the comment letters. The College specifically requested that MHD further investigate the impacts of the additional traffic generated by Ramp C-L on air and noise conditions inside its buildings. Charlestown businesses and residents asked for additional study and impact analysis on access to local businesses and access for residents of the Mishawam Housing located directly opposite the intersection of Ramp C-L with Rutherford Avenue. Some commenters suggested the relocation of Ramp C-L to the Sullivan Square area.

Response: Ramp C-L has been located to access local Charlestown traffic just southwest of Sullivan Square, avoiding Bunker Hill Community College. The traffic, air, and noise analyses for the Preferred Alternative, including this refinement, have been described in Chapter 4 of this FSEIS/R. No further analyses have been conducted to describe impacts to air, noise, and access in the vicinity of the College.

Two-Way Tunnel.
Comments: Design refinements aimed at reducing the width of the crossing included the feasibility of a two-way tunnel beneath the Charles River.

Response: MHD analyzed the feasibility of constructing a two-way tunnel carrying the I-93 mainline in tunnel beneath the Charles River. For a complete discussion of the implications of this refinement see Section 2.4.4(c).

Millers River Intersection.
Comments: There is an at-grade intersection at the Millers River which results in the fill of 1.1 acres of the watersheet in the northern portion of the river under all three new design alternatives. Commenters questioned whether this filling could be avoided or reduced.

Response: The Millers River intersection was developed during the BDRC process and was a feature of all three new design alternatives. The partial filling of the Millers River, a degraded water body, allows for a greater setback of loop ramp structures from the north bank of the Charles River. Refer to Section 4.5 for detailed discussion.

Leverett Circle.
Comments: Several residents and institutions within the Beacon Hill/Storrow Drive area raised specific design concerns regarding the design in the Leverett Circle/ Storrow Drive area. Residents in this area are concerned that the Preferred Alternative design will jeopardize the "parkway" character of Storrow Drive. They have asked MHD to design this portion of the Charles River Crossing to parkway standards.

Response: The identification of the Preferred Alternative avoids deficiencies with respect to traffic operations which occurred under Alternative 8.1D Mod 5 (severe congestion at Leverett Circle) and the Reduced-River Tunnel Alternative (diversion of traffic to local streets and indirect access to the joined highway system). While the Preferred Alternative provides for an underpass at Leverett Circle, construction of this underpass is in fact farther removed from the Esplanade than the existing westbound underpass. The Preferred Alternative does not adversely affect the character of Storrow Drive or the Esplanade.

West of Rutherford Avenue.
Comments: Residents of Cambridge were opposed to the massive visual intrusion created by the several (six) loop ramps in varying profile of Scheme Z. During the review period residents of Cambridge have requested that the Preferred Alternative include minimized intrusion of loop ramps west of Rutherford Avenue.

Response: The Preferred Alternative has three ramps decreasing to two ramps west of Rutherford Avenue. The ramps are Central Artery North to Tobin Bridge North/Route 1 (Ramp C-T), Tobin Bridge South/Route 1 to Central Artery South (Ramp T-C) and Storrow Drive East to Tobin Bridge North/Route 1 (Ramp S-T). Ramps C-T and T-C have similar profiles; therefore, they would appear as one ramp to the viewer located in the North Point area in East Cambridge. The impact compared to Scheme Z, therefore, is minimized due to the fewer number of ramps, as well as the lower height and concentric alignment which places the ramps in the same profile (see Section 2.3.3).

Comments: The City of Cambridge was opposed to lowering the profile of Ramp C-T beneath the railroad tracks due to the potential interference with development of the North Point area.

Response: This refinement was not compatible with minimizing the visual intrusion within the area west of Rutherford Avenue due to the design not being located in the same profile as the other ramps (See Section 2.4.1(c)).

Lomasney Way/Nashua Street Area.
Comments: There was a concern of residents and businesses in the vicinity of the North Station area that the Martha Road/Nashua Street (Lowell Square area) Ramp M-N would be designed to preclude BRA's land use goals for the Lomasney Way parcel.

Response: The function of Ramp M-N occurs at Leverett Circle with the Preferred Alternative. Therefore, the impacts on the Lowell Square area are minimized through the selection of the Preferred Alternative.

Comments: The BTD is concerned that the relocation of Nashua Street in the Non-River-Tunnel Alternative's design will adversely affect the economic viability of the parcels that abut Nashua Street.

Response: The Preferred Alternative realigns Central Artery northbound to Lomasney Way (Ramp CN-L) parallel to the MBTA railroad with a new intersection on the east side of existing Nashua Street. The realignment of Nashua Street in this area is no longer required. The remaining vacant parcels under the Preferred Alternative are larger than in the Non-River-Tunnel Alternative as it was described in the DSEIS/R, and therefore have greater visibility. The MBTA air rights garage parcel can be consolidated with the Nashua Street parcel in a design which maximizes the access to the Nashua Street parcel. The Registry building is now no longer encumbered with boat sections, and all roads adjacent to the building are at grade which maximizes and encourages pedestrian access. The ventilation building is sited next to the new MBTA garage and not adjacent to the Registry building.

New Sudbury Street On-Ramp.
Comments: BTD commented that the increase of boat sections on the mainline of the Central Artery because of inclusion of the local Boston access to I-93 northbound (New Sudbury on-ramp) narrows Cross Street, a local street in the North End. The new design would result in the elimination of a parking lane. In addition, BTD wants consistency with the other agreements throughout the Project where surface street restorations include the provision for bicycle operation in mixed traffic.

Response: MHD recognizes the concerns of the BTD with respect to the restricted corridor within the Cross Street area. MHD will continue to work with BTD through design development to address design improvements which balance pedestrian, vehicular, and bicycle needs. The width of the two northbound lanes for Cross Street is consistent with the widths shown for the entire surface restoration plan for the Project. Travel lanes are 11 feet with 1-foot setbacks. Sidewalk dimensions are consistent with existing conditions in areas where additional right-of-way is not available.

7.3.3 Bridge Design

The design of the bridge across the Charles River continues to be the focus of concern from primarily Cambridge and Charlestown. The commenters have consolidated their support for a cable-stayed type design which minimizes width and height. During the BDRC process of the bridge, MHD hired one of the world's leading design authorities on cable-stayed bridges, Dr. Christian Menn of Switzerland.

The BDRC and a majority of Cambridge and Charlestown residents generally support the cable-stayed designs that were developed by Dr. Menn. The following is a summary of the comments regarding the Charles River Crossing bridge(s).

Bridge Type.
Comments: Commenters indicated that there was confusion about the commitment of designing a Menn-style cable-stayed bridge when the DSEIS/R mentions other alternative bridge styles (e.g., tied-arch, long-span truss).

Response: MHD is obligated to prepare a bridge type study in order to be eligible for funding from FHWA. MHD is committed to pursuing the design and construction of a landmark cable-stayed bridge structure. A bridge type study was prepared for the 1986 FEIS/R analyzing the feasibility of constructing different styles of bridges. Another type study was prepared for Scheme Z and the three design alternatives described in the 1993 DSEIS/R. The recommendation reached for Scheme Z and the three design alternatives (which can be applied to the Preferred Alternative mainline bridge) is a cable-stayed bridge. MHD will continue to coordinate with FHWA throughout the design of the Preferred Alternative to provide that every effort is made to include a cable-stayed bridge as the preferred design.

Comments: Commenters also indicated a preference to have a Christian Menn style cable-stayed bridge.

Response: Dr. Menn has been retained by MHD to offer review and comment on bridge design which is being conducted by the Management Consultant Bridge Group. He will continue to offer support and overall design review upon completion of Project design.

Comments: Many of the commenters cited preference for a single bridge no wider than 10 lanes across.

Response: The Preferred Alternative is the Non-River-Tunnel Alternative which is 14 lanes across the river on two bridges. MHD conducted several analyses to minimize the width of the crossing. The mainline bridge, which accommodates the north and southbound lanes of I-93 and the New Sudbury south on-ramp, is 200 feet wide; the second bridge, which accommodates Storrow Drive movements, is 70 feet wide. It should be noted that the mainline bridge, which is 10 lanes wide, is narrower than that of the Reduced River-Tunnel Alternative. The mainline bridge will be designed as a "gateway" bridge; MHD has restated this commitment during the public comment period. The Storrow Drive bridge is the minimum width for a multiple span structure based on FHWA criteria.

Comments: Commenters indicated a preference to have the design of the bridge remain as open as possible to allow the motorist maximum views of the Charles River Crossing area.

Response: MHD design criteria requires a 3-foot-high jersey barrier along the shoulder of the road. The railing devices on top of the jersey barrier will be open-type metal railing. This configuration will allow limited views to the motorist of the surrounding Charlestown, Cambridge, and Boston communities.

Comments: The DEP raised the concern that bridge structures and associated piers would result in obscuring the views of the dam and lock operators at the new Charles River Dam.

Response: Analysis of the Non-River-Tunnel Alternative in the DSEIS/R indicated that there were no impacts to the dam operators' ability to observe boat traffic upstream of the Charles River Dam. A further visual analysis will be conducted to determine the field of the vision of the dam operator. MHD will fund telemonitors at the dam if the results of the analysis indicate that the structures impede the views for safe operation of the dam for boat traffic.

7.3.4 Transportation

HOV Lanes On I-93.
Comments: Many commenters requested that MHD consider an HOV ramp connection from I-93 to Leverett Circle, East Cambridge, or the MBTA Lechmere MBTA area as part of the Preferred Alternative.

Response: The concept can be reviewed as a potential design refinement during subsequent preliminary design; however, design difficulties arise in transferring HOV traffic from the inside lane across multiple lanes of general-purpose traffic to an exclusive HOV ramp serving an intermediate destination.

Leverett Circle.
Comments: Concerns were expressed that the new eastbound underpass and other highway improvements proposed at Leverett Circle would encroach on the Esplanade.

Response: The existing westbound underpass will remain intact; this creates a barrier which prevents new construction from encroaching on the Esplanade. Therefore there will be no direct construction impacts on the Esplanade as a result of construction of the proposed eastbound underpass.

Circumferential Transit Line.
Comments: Several commenters requested that the circumferential transit line being studied by the MBTA be accommodated by the Charles River Crossing design alternatives.

Response: The route location and design of the circumferential transit line are largely conceptual at this point and lacking in specifics; it is therefore not possible to evaluate the potential mutual impacts of the two projects. However, since the Preferred Alternative is largely on viaduct, alternative surface or subsurface crossings of the circumferential line through the Central Artery corridor can likely be accommodated as the concept is advanced to the preliminary plan stage.

Capacity Limitations.
Comments: Some commenters proposed that the solution to the problem of the Charles River Crossing was simply to limit the capacity of the proposed bridges to current levels.

Response: Placing arbitrary limitations on capacity misunderstands the role of traffic demand in setting roadway supply levels and how demand is determined. While total demand cannot be satisfied, the present capacity levels are clearly inadequate. Proposed capacity levels of the Project's major roadway elements are based on projected land use as determined by entities such as the Boston Redevelopment Authority and the Metropolitan Area Planning Council. The land use projections are then used to forecast person trips with disaggregation into vehicle trips, transit trips, and walk trips, taking into account anticipated improvements to the transit system. The purpose is to provide sufficient and safe capacity for the volume of forecast vehicle trips within physical and financial constraints.

North Station/South Station Rail Link.
Comments: Several comments dealt with the proposed link: whether it and the Central Artery could be constructed as one project and why the ridership forecast for the rail link was not used to modify the Project traffic projections.

Response: While the rail link project must undergo its own environmental review process, the CA/T Project plans and design details are being modified to preserve the potential for future construction of the rail link in the Central Artery corridor. MHD commits that the Charles River Crossing design process will not hinder or preclude construction of the North Station/South Station rail link. Until environmental review of the rail link project is complete, MHD cannot consider the effects on traffic projections. The Preferred Alternative provides flexibility to the design of the rail link in the Charles River area.

7.3.5 Aquatic Resources

Comments: Several commenters cited that the Project should be evaluating the impacts in aquatic resources based on the full implementation of the conditions of the CANA Chapter 91 License.

Response: The CANA project as originally designed will not be completed. Key elements of the project, namely the loop ramps connecting CANA with the Central Artery will be built as part of the Central Artery/Tunnel Project for the Charles River Crossing. Depending on the configuration of the Crossing which is ultimately constructed, portions of the CANA project which have already been completed may need to be removed.

Given that only a portion of the CANA project will ever be built, it is reasonable and appropriate that only a portion of the mitigation be constructed. An equivalent or greater amount of mitigation will be actually provided under the mitigation plan for the New Charles River Basin. It is inappropriate, however, to assume that the full CANA mitigation package is now complete for the purposes of evaluating the impacts of the Charles River Crossing portion of the Central Artery/Tunnel Project. Since the Charles River Crossing incorporates highway components designed to serve the functions of the unbuilt elements of the CANA project, mitigation for the remainder of the CANA project has become part of the mitigation which is to be provided for the Charles River Crossing (see Chapter 6 and the Final Section 4(f) Evaluation in the FSEIS/R).

Comments: DEP requested that the Project "develop an adequate functions and values assessment of impacts to the Millers River giving full consideration to the violations that may have already occurred which have resulted in water and wetlands values degraded from what they might otherwise have been." The Cambridge Conservation Commission is requesting that mitigation for the Charles River Crossing presume that restoration of the river has occurred.

Response: MHD cannot assess the legality of the alleged placement of fill in the Millers River by others. Nor can MHD, acting alone, assess how much of this alleged fill occurred prior to the effective date of wetlands regulations. The approach employed is an evaluation of the impacts of the Crossing on the water body based on existing conditions, in accordance with applicable State and Federal regulations.

Comments: A number of commenters questioned the accuracy of DSEIS/R delineation of existing wetlands resource areas at the Millers River, and identification of the important wetlands values and functions provided by the river's wetlands.

Response: The MHD delineated and mapped the State wetland resource areas in 1991. This delineation (which did not include any Bordering Vegetated Wetlands (BVW)) and the supporting technical information was provided in a Draft Request for Determination of Applicability to the Cambridge Conservation Commission (CCC). Based on two site visits in 1991 with the CCC, the delineation was modified to include three small discrete areas of BVWs on the westerly side of the river totalling 180 sf. At the same time, a formal Request for Determination of Applicability to confirm the delineation was submitted to the City of Boston which concurred with the delineation and issued a positive Determination of Applicability in 1991. No appeal to this decision was requested by DEP or others.

Another confirmatory delineation of the BVW was undertaken by MHD in the fall of 1993. The CCC and the DEP Wetlands Division have had the opportunity to review this delineation. Without conceding the accuracy of the original delineation, MHD has prepared a redelineation in this FSEIS/R. This information is included in Appendix D and modifies the delineation to include 2,300 sf of BVW.

The functions and values assessment of the aquatic resources of both the Charles and Millers Rivers undertaken in 1989 was also revised and updated. The revised assessment demonstrates that the only significant aquatic functions of the Millers River are limited to sediment/toxicant retention and nutrient retention/ transformation.

Comments: DEP and Cambridge Conservation Commission questioned the Secretary of Environmental Affairs Certificate establishing the Charles River Crossing as a water-dependent infrastructure improvement, under Chapter 91 regulations. Specifically they questioned the status of the ramps over and the intersection through the Millers River.

Response: The Secretary's Certificate stated the fact that all Project elements which were part of Scheme Z, including ancillary structures, are water-dependent. An alternatives analysis of the design and location of the intersection through the Millers River has been prepared which demonstrates that there are no reasonable alternatives and that the Crossing as a whole is water dependent (see Appendix C).

Comments: The DSEIS/R states that the functions and values of the Millers River are minimal and therefore no replication should be required. Commenters suggest that with a strong policy of no net loss of wetlands, the Millers River, should not be dismissed as valueless.

Response: The applicability of State and Federal wetlands replication requirements has been revisited in the FSEIS/R.

A functions and values technical report has been prepared and includes an analysis of existing aquatic conditions; identification of the Principal Valuable Function (PVF); and evaluation of Project impacts on the PVFs. Notwithstanding the limited PVFs of the Millers River, substantial mitigation is being provided by MHD (see Chapter 6).

Comments: Of particular concern to commenters was that filling in the Millers River in the absence of compensatory flood storage will adversely impact that capacity.

Response: The Charles and Millers Rivers are hydraulically connected by two 84 inch culverts. Because the level of the rivers is controlled by the new Charles River Dam there is no adverse effect on flood storage in the Charles River Basin due to the filling of a portion of the Millers River.

According to FEMA's *Flood Insurance Study* (Nov. 1990), the 100-year flood event occurs at an elevation of 104.3 ft for the Charles River Basin and the 500-year flood event occurs at elevation of 106.0 feet. Because the Charles River Basin elevation governs the Millers River elevation, flooding does not overtop the banks unless a 500-year plus storm event were to occur such that the 107.5 foot elevation is exceeded.

The current potential flood storage capacity of the Charles River is 5,049,000 cubic feet; that of Millers River is 408,000 cubic feet. The maximum potential flood storage capacity of the Millers River is equivalent to 8 percent of the potential flood storage capacity of the Charles River Basin (between the old and new Charles River Dams) or a depth of 5 inches over the entire lower basin.

This additional water would not raise the flood elevation since the Millers River is located at the mouth of the Charles River and flooding on the Millers occurs before the lower Charles River Basin floods. Thus, the water can be discharged by gravity or pumping through the dam to maintain the normal low water elevation of 102.4 feet. Hence, there would be no adverse impact to the Charles River flood storage capacity if the Millers River were to be filled. Nevertheless, in response to the concern, the theoretical loss of flood storage will be compensated by creating a water feature in the North Point area.

Comments: Some commenters felt that impacts to the Millers River are so severe that complete replication of the river and its wetlands function must be required.

Response: MHD's analysis demonstrates that the Millers River serves minimal aquatic functions. The Charles River Crossing mitigation plan includes development of a water feature which replicates all lost principal valuable functions for Federal justification of wetlands and meets the performance standards for State wetlands resource areas (see Chapter 6).

7.3.6 Construction

Comments: The MBTA listed several areas that could be potentially affected by the construction of the Project.

Response: The MHD is committed to detailed coordination with the MBTA to allow full access to all of its facilities, to avoid any shutdowns in operations, and to minimize adverse impacts to the current operating conditions. Construction planning will be developed as follows:

- Public access to all MBTA commuter/rapid transit facilities will be maintained.
- Access to all MBTA facilities will be maintained.
- Special construction means and methods will be employed to protect MBTA facilities, such as the Orange and Green Lines.
- Construction work hours will be scheduled so that MBTA peak hours of operation will not be affected. Activities requiring a slowdown or suspension of activities (such as construction of viaduct superstructures over rail lines) will be conducted at off peak times in consultation with the MBTA.
- Design and, especially, construction activities will be coordinated with the MBTA to effect an efficient scheduling of MHD roadway and MBTA Green Line construction.

Comments: The construction of the bridges over the Charles River will require work to be conducted in the Charles River. Several commenters requested additional information regarding the impacts to navigation.

Response: During design development, close coordination will be conducted with the USCG, MDC Dam Operations, and other affected agencies. Prior to commencement of construction, the contractor(s) will be required to submit a navigation safety plan. Some of the major requirements will included the following:

- The Charles River will be kept open for navigation except for an occasional very short, off-peak period (such as when the existing mainline bridge is dismantled at the end of the Project).

- Construction operations will be planned so that all locks in the MDC dam can remain in operation. Some temporary closures of the southernmost lock may be necessary.

- Where necessary, turbidity control curtains will be installed.

- Water quality testing will be conducted in coordination with DEP while construction in the water is taking place.

- Under USCG guidance, navigation buoys and temporary fenders will be installed during construction activities.

Comments: Several commenters were concerned with the impact of construction on the Area North of Causeway Street with respect to staging layout of construction materials and haul routes. In addition there was concern regarding contaminated materials that maybe encountered during construction activity.

Response: Construction activities will require staging/laydown areas for the contractors, prescribed haul routes, and a system of disposal of excavated material which is classified as hazardous or otherwise unsuitable for backfill. The issue of materials disposal was covered in the 1993 DSEIS/R, Section 5.3. In all, some 490,000 cubic yards of material is expected to be removed from the area and disposed of as outlined in the 1993 DSEIS/R. The material, depending upon its classification, will be transported to the Massachusetts Bay Disposal Site, a site licensed to handle hazardous material, or the Materials Processing Operation in South Boston for further disposition, or will be reused as backfill.

Truck routes for hauling of construction equipment and materials, and for disposing of excavated material and other construction debris will generally follow established main travelled ways. Every effort will be made to minimize traffic on side streets and feeder routes. It is anticipated that at the peak construction period no more than 100 truck trips daily will be made on any travelled route. Such routes include I-93/Central Artery, Storrow Drive/Leverett Circle, Rutherford Avenue, and the CANA loops ramps.

Construction laydown areas will be located, wherever possible, in or adjacent to the construction right-of-way. These areas will have minimal impact on surrounding commercial or traffic operations. One area, however, that might be affected are the parking lots on Nashua Street that are used by employees of the Massachusetts General Hospital. Here, a temporary easement may be required for the area adjacent to the tunnels to be constructed in the area.

7.3.7 Air Quality

Agencies with jurisdiction over implementation of the Clean Air Act indicated that the methodology and the results of the air quality analyses were consistent with regulatory requirements. The results of the analyses indicated that all three new design refinements were an improvement over Scheme Z based primarily on a reduction of VMT due to the elimination of the double crossing of the Charles River. The Non-River-Tunnel Alternative and the Reduced River-Tunnel Alternative resulted in the greatest amount of emissions reductions overall and lowest local CO emissions at three key intersections: Leverett Circle, Keany Square, and City Square. The following summarizes the major issues of commenters with respect to air quality issues.

Comments: The EPA inquired as to whether the Project was in compliance with the SIP (State Implementation Plan).

Response: The air quality analysis performed for the three design alternatives demonstrates that the Project meets all National and State Ambient Air Quality Standards and Guidelines and result in lower area wide vehicular emissions than those estimated with Scheme Z. As a consequence, the results of the Analyses comply with the requirements of the 1990 Clean Air Act Amendments, the State Implementation Plan, and the recently released Final Conformity Rule.

Comments: The Bunker Hill Community College and several residents of Cambridge were concerned about what they thought was a lack of information regarding the air quality impacts of Ramp C-L.

Response: Ramp C-L has been relocated to the Sullivan Square area. Air quality impacts have been taken into consideration in evaluating the effects of the Project alternatives at Bunker Hill College. The air quality analysis estimated carbon monoxide (CO) levels for each alternative at seventeen locations around the intersection of Rutherford Avenue and the Gilmore Bridge, and at 12 locations in the vicinity of Rutherford Avenue and Ramp C-L. The results of the analysis indicates that the CO levels at all of these locations are below the National and State Ambient Air Quality Standards for all the three alternatives analyzed.

Minot Station Steam Generation Plant.
Comments: The EPA has indicated that all three new design alternatives result in the displacement of the BTEC's Minot Station steam generating plant, which requires further air analysis. Specifically, how will the service (steam) be replaced, and what types of State and Federal permits are required. For the analyses they suggest that the FSEIS/R include the following scenarios: (1) upgrade of existing plant at Kneeland Street; (2) construction of a replacement plant; or (3) relocation of the existing facilities in a new ventilation building on the south side of the Charles River.

Response: Under the Preferred Alternative, the Minot Station steam generating plant will be removed to create space for the ramps at Leverett Circle. A Force Account has been established by the MHD allowing the Boston Thermal Energy Corporation, owner of the Minot Station, to study functional replacement options.

7.3.8 Urban Design & Visual

Comments: The City of Boston was concerned about the effect of the Storrow connector ramps on the long range goals to develop the MBTA air rights parcel.

Response: The Preferred Alternative will affect the developability of the MBTA air rights parcel the greatest amount of all new alternatives. Ramp N-S and S-N traverse the southerly portion of the MBTA commuter railroad parcel planned for an air rights garage, removing approximately 49 percent of the garage area and restricting the design of internal circulation. Access to the garage from Nashua Street is impeded somewhat more than in Scheme Z. Tunnel Ramps LC-S, CN-S, and CN-L under the MBTA commuter railroad parcel require modification to foundations for the air rights garage. Development potentials can be facilitated by combining with the adjacent joint development parcels.

Comments: The City of Cambridge expressed concern regarding the impacts of the Project on the development of the North Point Project.

Response: The Preferred Alternative does not require a casting basin or river tunnel construction which would have delayed the development of the North Point project for at least five years. The Preferred Alternative greatly reduces the physical and visual impacts of the loop ramp structures on the North Point development area.

Comments: Commenters located in the Nashua Street area were concerned about future development potential and accessibility issues. One such commenter was the New Boston Garden Corporation (NBGC).

Response: The MHD recognizes the pedestrian and vehicular accessibility demands of the new arena, and the architectural resolution of these demands that will soon be constructed by the NBGC. The MHD recognizes the NBGC as providing a major contribution to the North Station environment. To provide a successful urban environment the MHD seeks to integrate its own contributions with the contributions of others, as far as possible. It is anticipated that valuable coordination discussions will facilitate the development of both the new Boston Garden Complex and the Preferred Alternative.

7.3.9 Open Space/Parklands

Open Space/Parklands.
Comments: The MDC requested the Project design and construct continuous pedestrian and bicycle connections as called for in the MDC New Charles River Basin Master Plan, including connections over the railroad tracks on both sides of the river, under both ends of the North Washington Street bridge, on both sides of the MBTA bascule bridge, and at other locations as indicated in the Master Plan.

Response: As indicated in the Final Section 4(f) Evaluation, design and construction of park developments on MDC-owned parcels and other parcels, and development of continuous pedestrian and bicycle connections are major elements in a mitigation program which represents planning to minimize harm to the Section 4(f) properties, which derive their significance as part of a system of Charles River parkland. The discussion of Measures to Minimize Harm includes a specific list of measures appropriate to the Preferred Alternative as discussed in detail in Chapter 6 of the FSEIS/R.

Comments: The MDC also requested full analysis of existing commitments, planning and requirements for improvements and a complete and explicit listing of proposed mitigation should be included in the FSEIS/R.

Response: The Final Section 4(f) Evaluation lists proposed mitigation in detail and distinguishes between improvements previously committed under Chapter 91 licenses from new mitigation offered for the Charles River Crossing. The mitigation program for the New Charles River Basin addresses the open space between the Charles River dams as a system and attempts to compensate for localized impacts by providing a high quality parkland system in Cambridge and Boston.

Comments: The City of Cambridge questioned MHD's assessment and consideration of construction impacts to 4(f) properties.

Response: Under Section 4(f), temporary impacts may or may not be a use of parkland depending on the scale and duration of the use; in the case of tunnel construction under the Charles River and Nashua Street Park, the temporary impacts are impacts that deserve consideration in the evaluation of alternatives, all of which use land within the parkland system. The subsurface use of the Nashua Street parcel delays its development by several years; the park was to have been completed prior to mainline construction in the mitigation program for Scheme Z.

7.3.10 Historic Resources

Historic Resources.
Comments: The DCPO questions the eligibility of 100 Nashua Street to the National Register and the economic viability of continuing public or private use of the building.

Response: The Registry Building is considered eligible for the National Register pursuant to Section 106 regulations governing the Project. This structure is contained in the Projects's Inventory of Historic Resources, which identifies all known historic properties and districts in the project area. As described in the 1991 FSEIS/R, the status of these resources falls into three categories: (1) those formally listed on the National Register of Historic Places (NR); (2) those determined eligible for listing by the Keeper of the National Register (NRDOE); and (3) those considered eligible for listing (NRE) by concurrence of FHWA and the State Historic Preservation Office (SHPO, represented by the Massachusetts Historical Commission, or MHC). The Registry Building is considered eligible within the third category, NRE.

MHC has also submitted a separate opinion (dated 4/21/93) individually assessing the Registry Building's eligibility for the National Register. In this opinion, MHC determined that the Registry building meets Criteria A and C of the National Register (associated with significant historic events and embodying distinctive architectural characteristics), and is significant on the local level.

Determination of eligibility for listing--whether by the Keeper of the National Register, MHC, or the MHD--is independent of the owner's concurrence and of actual inclusion on the Register. MHC and DCPO are engaged in discussions regarding the future of the Registry building.

Comments: There was a concern regarding the Projects ability to maintain the granite seawalls along the banks of the Charles River.

Response: The MHD's responsibility for the granite seawalls, as suggested by MHC and BLC during Section 106 review of the Draft SEIS, includes disassembling and rebuilding affected areas with existing materials, or in-kind, to match existing (not original or pristine) conditions. Rebuilding will occur only in those parts of the seawalls that are disturbed by Project construction (including the mitigation program); to this limited extent, the seawalls are likely to be improved by historically appropriate reconstruction.

7.3.11 Water Quality

Comments: The U.S. Fish and Wildlife Service expressed concern that combined dredge and fill activities have caused significant degradation of waters of the United States in the Charles River estuary system and as a result, even minor dredge or fill activities undertaken today should be viewed within this context.

Response: The proposed dredge and fill activities in the Charles and Millers Rivers have been reviewed only in the context of the Charles River Crossing portion of the Central Artery/Tunnel project. Adequate mitigation is proposed to provide that further permanent degradation of affected Waters of the United States will not occur.

Comments: The USACE requested additional soil characterization of sediments from the Millers River.

Response: Additional testing of materials to be dredged will be conducted during the final design process.

7.3.12 Fisheries

Comments: The main concern was that the shadow area on the water from the bridge structure may have an incremental effect on fish runs when coupled with other impediments to the fish migration already present.

Response: Section 4.5.4(b) describes the shadow cast by the bridge and structures. The Project determined that these shadows are not an impediment to migration since there has never been a documented incident where bridge shading has restricted migration.

Comments: The Boston Conservation Commission indicated that construction in the Charles and Millers River would likely require sediment control to protect fishes.

Response: The Preferred Alternative only involves construction of bridge piers in the Charles River. Fish will be deterred only from the area by sheet piling and silt curtains. These construction methods will minimize impacts to water quality avoiding impacts to fisheries. Sediment controls will allow fish to successfully move past construction areas.

7.3.13 Navigation

Comments: Commenters' main concern was to provide for safe navigation during construction and provide for reasonably obstruction free navigation after construction.

Response: Marine tunnel construction is not required for the Preferred Alternative; therefore, the cumulative impacts of bridge and tunnel construction on navigation in the Charles River are reduced. During brief periods of bridge deck construction immediately over the navigation areas and during dismantling of some sections of the existing I-93 viaduct, boat traffic may be restricted. The MHD will coordinate with the MDC to schedule these brief River closures during periods of off-peak boat traffic. If an emergency arises during a river closure period, the Project's contractors will cease work activity to allow the MDC to respond accordingly.

Comments: Some commenters were concerned with the close proximity of the bridge's cofferdam and the ability to use the third (southernmost) lock at the new Charles River dam.

Response: The cofferdam required to build the southern pier of the cable-stayed bridge may extend temporarily for a year into the area used for boats transiting the southernmost lock. This temporary occupation of the navigation area by the cofferdam will still allow boats under 40 feet in length to use the lock, although some temporary closure of this lock may be necessary. Since the wider lock will be available for boats over 40 feet in length, the impact on the MDC locks from cofferdam construction will be minimal and temporary. The contractors' navigation plans will address specific methods to accommodate boat traffic and queuing during construction.

Comments: Other commenters expressed concern with the pier fendering system and the navigational capacity left in the Charles River.

Response: The effect on navigation from the placement of bridge piers is an important design consideration for the Charles River Crossing. The MHD will provide a pier fendering system to protect the bridge structures, boats and barges in the Charles River. There will be no interference with navigation because the four piers required in the waterway to support the bridges will be behind existing fender pier lines. The elevation of the new crossings will be higher than the current restricting bridge. Therefore, both construction and operation of the new bridges will accommodate the current clearances. No construction activity, including the installation of safety nets under the bridges during construction will infringe upon existing vertical clearance.

7.3.14 Mitigation Program

Comments: DEP requested that the MHD provide a MDC mitigation program listing specific items, cost and schedules.

Response: The mitigation described in this FSEIS/R (see Chapter 6) is a commitment of MHD, which will be funded from Federal and State highway program funds. There is no requirement to appropriate or earmark funds for this purpose prior to need. Details of project implementation, including budgets, schedules, and responsibilities are addressed in the MHD's Memorandum of Agreement with the MDC.

8. List Of Preparers

Chapter 8
LIST OF PREPARERS

This section briefly describes the responsibilities and backgrounds of the key individuals who were involved in the preparation or review of the Charles River Crossing FSEIS/R for the Central Artery/Tunnel Project.

FEDERAL HIGHWAY ADMINISTRATION

Daniel Berman
Project Manager, Artery/Tunnel Project

Mr. Berman is the principal FHWA representative for the Artery/Tunnel Project, and is responsible for coordination and review of all phases of work. He has over 18 years experience in providing expert counsel to agency management and professional colleagues on a wide variety of planning and transportation issues. He has been with FHWA transportation engineering since 1974, and has worked in both regional and division offices in Louisiana, California, Kansas, New York, Colorado, Rhode Island, and, currently, Massachusetts. Mr. Berman holds a Bachelor of Science degree in Civil Engineering from Lamar University, Beaumont, Texas.

Jeffrey Firman
Environmental Engineer, Planning & Program Development

Mr. Firman coordinated the review and comments of this document by a multidisciplinary team. He has 23 years experience with FHWA in highway design and construction, including assisting in preparation of numerous environmental documents. Mr. Firman holds a Bachelor of Science in Civil Engineering from the University of Maryland and a Master of Science in Transportation Engineering from RPI.

MASSACHUSETTS HIGHWAY DEPARTMENT

Peter M. Zuk
Project Director, Artery/Tunnel Project

Mr. Zuk directs the Artery/Tunnel Project. He brings to these challenges 9 years in private law practice and 4 years with the office of the Massachusetts Attorney General as Chief of the Contracts Division, and later as Deputy Attorney General. Previously, he practiced law in Washington, D.C., concentrating in construction law and civil litigation. In 1991 he became Director of the Project, where he has full management responsibilities and oversees the management consultant, the joint venture of Bechtel/Parsons Brinckerhoff. In this role, he is also key liaison to MHD and EOTC, and is the primary Project spokesperson to the general public and media. Mr. Zuk is a graduate of Colgate University and Boston College Law School.

William Flynn
Deputy Project Director, Artery/Tunnel Project

General Flynn joined the Project in May 1992. A 35-year Army veteran, he most recently served as Commanding General, 21st Army Area Command, the European Theater. As Deputy Project Manager, he oversees internal operations, including direct liaison with B/PB core management. General Flynn holds a Bachelor of Science degree in Business Administration from Providence College and a Master of Science degree in International Relations from George Washington University.

Michael P. Lewis
Project Manager, Charles River Crossing FSEIS/R

Mr. Lewis was the MHD manager for the Charles River Crossing FSEIS/R. He was responsible for implementing Executive Office of Transportation and Construction policy direction relating to the design for the crossing, and to the FSEIS/R. He coordinated B/PB project management for the FSEIS/R, key editors, and was the primary liaison to special interest/citizens groups. Mr. Lewis has 9 years of design engineering experience with the MHD's District One Office. He attended McGill University, Montreal, Canada, and holds a Bachelor of Science degree in Civil Engineering from the University of Vermont.

Paul A. Stakutis
Manager of Environmental Planning, Artery/Tunnel Project

Mr. Stakutis is responsible for environmental matters associated with the planning, design and construction of the Project. He has 16 years of environmental law and project management experience for major engineering and construction firms. He holds a Bachelor of Science degree from Boston College and a Juris Doctor degree from Suffolk University Law School, Boston.

Robert M. Ruzzo
Senior Counsel, Environmental, Artery/Tunnel Project

Mr. Ruzzo was responsible for the legal review of the Charles River Crossing FSEIS/R. He also participated in general FSEIS/R mitigation discussions with State and Federal agencies and in negotiations for the First Amendment and Restatement of the MOA among EOTC, EOEA, MHD, and the MDC. He is also the Project's legal representative on the Central Artery Environmental Oversight Committee. He headed the MHD team that reviewed FSEIS/R materials, closely working with B/PB editors of the document. Mr. Ruzzo holds a Bachelor of Arts degree from Colby College in Waterville, Maine, and a Juris Doctor degree from Georgetown University Law Center.

Gloria A. Fry
Counsel, Environmental, Artery/Tunnel Project

Ms. Fry reviewed FSEIS/R sections on water resources, materials disposal, and hazardous waste. She has 22 years experience in Massachusetts government, materials disposal, water pollution control, overall environmental protection, and hazardous waste cleanup. Ms. Fry has served as Senior Deputy General Counsel with the Massachusetts Department of Environmental Protection. She holds an A.B. degree in Biology from Bryn Mawr College and a Juris Doctor degree from Suffolk University Law School, Boston.

Margaret Gilmore
Environmental Attorney/Counsel, Artery/Tunnel Project

Ms. Gilmore was a member of the Project's Mitigation Task Force charged to determine, sort and geographically assign wetlands and waterways, and parkland 4(f) mitigation measures to the Charles River Basin area with the goal of meeting regulatory requirements while maintaining consistency with the Metropolitan District Commission parkland master plan. She also participated in general FSEIS/R mitigation discussions with State and Federal agencies and in negotiations for the First Amendment and Restatement of the MOA among the EOTC, EOEA, MHD and the MDC. Ms. Gilmore has 17 years experience in the design and construction field, in both the public and the private sectors. She holds a Bachelor of Arts degree in Economics with a minor in Civil Engineering and a Juris Doctor and Master of Studies in Environmental Law degrees.

Martin A. Nee
Manager of Mitigation and Community Affairs, Artery/Tunnel Project

Mr. Nee implemented the community relations plan for the Area North of Causeway Street subarea. Prior to joining MHD, Mr. Nee was chief of staff for a Representative to the Massachusetts Legislature, responsible for managing community affairs. He has 10 years of experience in community affairs in Boston. He received a Bachelor of Arts degree in Political Science from Boston College.

BECHTEL/PARSONS BRINCKERHOFF, MANAGEMENT CONSULTANT

Theodore G. Weigle, Jr.
Project Executive

Mr. Weigle, a Vice President of Bechtel Corporation, oversees the design, construction, and environmental activities for the Artery/Tunnel Project, a joint venture of Bechtel and Parsons Brinckerhoff. He has served as the Executive Director of the Chicago Regional Transportation Authority and as Deputy General Manager for the Washington Metropolitan Area Transit Authority. He holds a Bachelor of Science degree from the State University of New York at Cortland and completed the Advanced Management Program at Harvard University's Graduate School of Business.

Sallye E. Perrin, P.E.
Deputy Project Manager

Ms. Perrin, as Environmental Core Manager, had overall responsibility for this FSEIS/R. She has over 16 years of experience in engineering and planning, including environmental compliance coordination and documentation for major transportation projects, environmental impact analyses, transportation alternatives analyses, land use planning, and public participation program development. Ms. Perrin received a Bachelor of Science degree in Environmental Sciences and a Master of Science degree in Civil Engineering, both from the University of Virginia.

Edward W. Ionata
Environmental Services Manager

Mr. Ionata provided direction and review for this FSEIS/R. He has 11 years of experience in environmental analysis and management for major infrastructure construction projects, including interdisciplinary environmental planning, permitting, and compliance. Most recently he was with the Massachusetts Water Resources Authority where he managed construction related environmental permitting. Mr. Ionata holds a Bachelor of Science degree in Natural Resources from the University of Rhode Island and a Master of Forest Science from Yale University School of Forestry.

Jeff J. Brunetti, P.E.
Manager, Preliminary Engineering

Mr. Brunetti was the primary liaison between the management consultant and MHD for this FSEIS/R, and particularly for the alternative designs presented in the Draft document. He has 15 years of experience in the design and management of national and international transportation projects. Mr. Brunetti has a Bachelor of Science degree in Engineering from the University of Colorado at Boulder with a concentration in Structural Engineering.

Allan A. Hodges, AICP
Manager of Environmental Documentation

Mr. Hodges managed the preparation of the FSEIS/R and was responsible for its compliance with applicable EIS/R regulations, and for consistency with commitments made by MHD and FHWA in the 1991 FSEIS/R. He contributed several sections of the FSEIS/R text, and managed the editorial review process. He chaired the Mitigation Task Force whose results are presented in Chapter 6 of the FSEIS/R. Mr. Hodges also was Editor-in-Chief for the Charles River Crossing 1993 DSEIS/R, the 1992 Notice of Project Change (NPC) for the Revised Charles River Crossing, the 1991 Projectwide FSEIS/R, and principal author of the 1990 South Boston Haul Road SEIS/R. Mr. Hodges has over 27 years experience in project management and environmental impact report preparation and permitting for transportation, water resources, and development projects. He holds a Bachelor of Science degree in Community Development from Southern Illinois University and a Masters degree in Urban Planning from Michigan State University.

James A. Vears
Manager, I-93 Engineering

Mr. Vears, a professional civil engineer, manages design and engineering for the I-93 section of the Central Artery/Tunnel Project. He provided quality control review and managed preparation of design development for the Charles River Crossing FSEIS/R. He holds a Bachelor of Science degree in Civil Engineering.

Elizabeth Vincent
Manager of Traffic and Transportation

Ms. Vincent provided direction and review for the Traffic/Transportation portion of this FSEIS/R. She has 18 years of experience in traffic engineering, transportation planning and environmental analysis. Ms. Vincent has also managed major environmental and design projects throughout the United States. She holds a Bachelor of Science degree in Civil Engineering from the University of Utah and a Bachelor of Arts degree in Design from the University of Southern Florida.

Richard A. Azzalina
Senior Civil Engineer

Mr. Azzalina was responsible for the development of conceptual and preliminary civil highway alignments for the I-93 segment of the Project from Kneeland Street to its northern limits. He developed approximately 80 design options for the Charles River crossing during the past 6 years, and provided technical support to the Bridge Design Review Committee for 2 years. Mr. Azzalina also provided technical support, including engineering drawings, in the development of the 1991 FSEIS/R, the 1992 BDRC recommendation to the Secretary of Transportation, and the 1992 NPC. In addition, Mr. Azzalina conducted a technical review of Chapter 2 for this document and provided engineering drawings for all four designs presented in the 1993 DSEIS/R. Mr. Azzalina has nearly 20 years of experience, with specific focus in highway design. Mr. Azzalina holds a Bachelor of Science degree in Civil Engineering from Northeastern University.

Christopher Barnett P.E.
Material Disposal Supervisor, Project Engineering

Mr. Barnett wrote the hazardous material section of this report. He has 9 years of experience in environmental/regulatory policy; as a technical manager for the MWRA and as a general engineer in the field of mechanical/metal fabrication. Mr. Barnett holds a B.S. degree in Mechanical Engineering and a Master of Science in Technology and Policy from MIT.

Chetlur G. Balachandran, Ph.D.
Noise and Vibration Specialist

Dr. Balachandran wrote the section on noise and vibration for the FSEIS/R. He has 33 years experience in acoustics, noise, and vibration on highway, transit, and railroad projects and in architectural and engineering noise control in the United Kingdom, New Zealand, Canada, and the United States. Dr. Balachandran received his Bachelor of Arts, Master of Science, and Ph.D. degrees in Acoustics from Madras University, India.

Robert Belknap
Senior Traffic Engineer, Supervisor

Mr. Belknap assisted in preparation of the transportation analyses for the transportation chapter of this report. He has over 24 years of experience in traffic engineering. Mr. Belknap holds a Bachelor of Science degree in Civil Engineering from California State University at Los Angeles and a Master of Transportation Engineering from the University of California, Institute of Transportation Studies, Berkeley.

James P. Carmody, P.E.
Senior Traffic Engineer

Mr. Carmody supervised preparation of the technical traffic analysis, prepared the maintenance of traffic section, and identified the traffic impacts from the construction staging for this report. He has 20 years experience in traffic engineering and transportation planning, and holds a B.S. in Civil Engineering and a Master of Science in Transportation Planning and Engineering from the Polytechnic Institute of Brooklyn.

Eric Chasanoff
Senior Air Quality Scientist

Mr. Chasanoff was responsible for producing the determination of energy uses due to construction and operation of this Project. Mr. Chasanoff has 18 years of air quality experience, he has worked for Parsons Brinckerhoff for this FSEIS/R for 3 years, EPA for 8 years and for the Department of Environmental Protection for the City of New York for 5 years. Mr. Chasanoff holds a Bachelor of Science in Meteorology from the University of New Hampshire and a Master of Science degree from NY Polytechnical Institute. In addition, Mr. Chasanoff is a professional certified consulting meteorologist (#400).

John Chisholm
Construction Planner

Mr. Chisholm prepared and wrote Chapter 5, Construction Impacts for this FSEIS/R. He has over 35 years experience in construction management. Mr. Chisholm holds a Bachelor of Science degree in Civil Engineering from Northeastern University and a Master of Science degree in Construction Engineering from Oklahoma State University.

Brenda Corbett
Senior Technical Writer/Editor

Ms. Corbett prepared the Summary and several sections of the FSEIS/R, participated in the design of the text layout, and prepared the List of Abbreviations. She also provided technical editing, proofreading, and quality control for the full text. She worked in a similar capacity in the preparation of the Projectwide 1991 FSEIS/R, the 1990 South Boston Haul Road SEIS/R, and other technical support documents for the Project. She has over 12 years experience in engineering and general business writing, and holds a Bachelor of Arts degree from Boston University.

Jonathan Crowley
Assistant Agency Liaison

Mr. Crowley was responsible for preparing the agency distribution list for the FSEIS/R and for the coordination and scheduling of meetings among appropriate agencies during the environmental review process. He assists in the administration of the Project cooperating agency program. He has a Bachelor of Arts degree in History from Salem State College.

John Cusack Jr., P.E.
Senior Utilities Engineer

Mr. Cusack was responsible for evaluating alternatives for the relocation of existing utilities for this FSEIS/R. He has 20 years of experience as a civil engineer, with his main area of expertise in water and sewer infrastructure systems. Mr. Cusack holds a Bachelor of Science degree in Civil Engineering from Tufts University and a Master of Sanitary Engineering from Pennsylvania State University.

Michael Garvin
Traffic Engineer

Mr. Garvin was responsible for conducting traffic analyses using computer modelling techniques. He also assisted in the evaluation and coordination of model output and in the tabulation of traffic volume and speed summaries for use in the FSEIS/R. Mr. Garvin holds a Bachelor of Science degree in Civil Engineering from Worcester Polytechnic Institute.

Melissa M. Laube, AICP
Senior Transportation Planner

Ms. Laube was the manager for the transportation chapter of the DSEIS/R. She has 15 years of experience in transportation systems analysis and planning. She received a Bachelor of Arts degree from Cornell University and a Master of City and Regional Planning from Harvard University's Graduate School of Design.

Lou-Deane Lipman
Senior Designer

Ms. Lipman was involved in traffic analysis for the DSEIS/R. She has worked for five years on the Project in the civil engineering and traffic and transportation areas. She has attended Massasoit Community College and is now attending Northeastern University Center for Continuing Education.

Owen J. MacDonald, P.E.
Supervising Traffic Engineer

Mr. MacDonald was responsible for traffic operations analysis of expressway segments and coordination of traffic data for air quality analysis. He has 21 years of experience and holds a Bachelor of Science and Master of Science in Civil Engineering from Northeastern University.

David Markt
Traffic Engineer

Mr. Markt was the traffic analysis coordinator for the transportation chapter of the FSEIS/R. He has over five years of experience in the traffic engineering field. He received his Bachelor of Science in Civil Engineering from Northeastern University.

Nancy Masison
Assistant Manager of Environmental Documentation

Ms. Masison reviewed FSEIS/R sections on alternatives, mitigation and section 4(f) resources. Before joining the Environmental Documentation Group, Ms. Masison worked previously on real property acquisitions in the right-of-way lands management department of the Project. Ms. Masison holds a Juris Doctor degree and a Certificate in Environmental and Natural Resources Law from Lewis and Clark Law School, Portland Oregon.

Marlin Meese
Senior Acquisition Specialist, Right-Of-Way

Mr. Meese prepared the right-of-way chapter of the FSEIS/R. Prior to joining the Project staff, Mr. Meese had over 30 years of highway right-of-way acquisition experience with the Federal Highway Administration. He has a Mathematics degree from the Mankato State University, Mankato, Minnesota.

Curtis C. Meininger
Senior Environmental Scientist

Mr. Meininger prepared the fisheries section of the FSEIS/R. He has 12 years of experience in aquatic resource analysis and remedial studies, including participation in the preparation of the 1991 FSEIS/R. He has a Bachelor of Science and Master of Science degrees in Biology from the University of Cincinnati.

Gina Park
Administrative Assistant, Environmental Services

Ms. Park produced the List of Preparers section for the FSEIS/R, and assisted with the Comments and Coordination Chapter of this FSEIS/R, as she did for the DSEIS/R. She has 6 years of administrative experience in the environmental, real estate, and legal fields. Ms. Park holds a B.S. degree in Cartography from Salem State College with a concentration in Urban Economics, and a certificate in Paralegal Studies.

Jeffrey M. Paul
Permit Supervisor

Mr. Paul reviewed drafts of the FSEIS/R for quality control as he did previously for the 1993 DSEIS/R and the 1992 Notice of Project Change for the Revised Charles River Crossing. He also assisted in the preparation of the Comments and Coordination Section. He is responsible for managing the preparation, filing, obtaining, and monitoring of all environmental permits, licenses, and approvals for the Project. Mr. Paul previously managed the preparation of materials disposal, wetlands and waterways, vegetation and wildlife, Section 404 (b)(1) analysis for water quality, and floodplain chapters for the 1991 FSEIS/R for the Project. Over the past 20 years, Mr. Paul has managed the environmental portions of major public infrastructure projects. He holds a Bachelor of Arts degree from Colby College and a Master of Arts degree in Urban, Social, and Environmental Policy from Tufts University.

Benjamin G. Perez, AICP
Planner

Mr. Perez prepared the energy impact analyses for the FSEIS/R and for the Projectwide 1991 FSEIS/R. He has a Bachelor of Arts degree from Amherst College and a Master of Science degree in Urban Planning from Columbia University.

Katherine A. Rafferty
Cambridge Community Liaison

Ms. Rafferty assisted with the preparation of the Comments and Coordination Section of this report. She previously worked on the Community Relations chapter in the DSEIS/R. Ms. Rafferty has been the Project's Cambridge Community Liaison for 2 years and has been a life long resident of Cambridge involved with the community and civic affairs. Prior to working for the Central Artery/Tunnel Project, Ms. Rafferty was a legislative aid at the Massachusetts State House. She holds a Bachelor of Arts degree in Economics from Boston College.

Stacy A. Richards
Agency Liaison Coordinator

Ms. Richards wrote the Agency Coordination section of the DSEIS/R, contributed to several quality control reviews of the FSEIS/R, and was responsible for regulatory filings and distribution of the document. She also was a member of the Mitigation Task Force. Since 1988 she has managed the cooperating agency program under the National Environmental Policy Act for the Project. The program involves issue identification and resolution of 30 Federal, regional, State, and local agencies and their divisions during the environmental review process. Ms. Richards has 15 years of Federal, legislative, and regulatory experience. She holds a Bachelor of Arts degree in Political Science from Bucknell University, and a Master of Public Administration from Harvard University Kennedy School of Government.

Marilyn Rowland, AICP
Senior Planner/Editor

Ms. Rowland has had numerous editing and writing responsibilities for the 1991 FSEIS/R including preparation of the summary and index for the 1993 DSEIS/R. She has 16 years of experience in urban planning, environmental impact analysis, and technical report editing. She has a Master of City Planning degree from Memphis State University.

Guido Schattanek
Senior Environmental Engineer

Mr. Schattanek is the lead air quality analyst for the Project. He has prepared the air quality section of this FSEIS/R, the DSEIS/R, the 1992 NPC and the air quality mobile source analyses for the 1991 FSEIS/R and the 1990 South Boston Haul Road SEIS/R. He also is the principal author of one of the EPA's guideline models for air quality, and is a national appointee to the Transportation Research Board's committee on transportation and air quality. Mr. Schattanek has over 15 years of experience in engineering and environmental modeling. Mr. Schattanek received his Bachelor of Science degree and Master of Engineering in Electrical Engineering from the National Technical University of Buenos Aires, Argentina, and a Master of Engineering degree in Environmental Engineering from Manhattan College, New York.

Michael T. Smither, P.E.
Senior Civil Engineer

Mr. Smither was responsible for designing the alternatives to the 1991 FSEIS/R Proposed Action analyzed in the DSEIS/R, and compared the effects of design alternatives. In addition, he evaluated realignment schemes meeting the requirements of the client and participated in making recommendations for revisions to the Proposed Action which have been included in this FSEIS/R. Mr. Smither has 28 years experience in civil and transportation engineering. He has a B.S. degree in Civil Engineering from the Virginia Military Institute.

Joel Soden, P.E. DEE
Supervising Air Quality Engineer

Mr. Soden assisted in the preparation of the air quality section of this Final SEIS/R and prepared responses of air quality-related comments on the Draft SEIS/R. He has over 20 years of experience in the supervision and preparation of air quality analyses for a wide range of transportation-related mobile source projects. He has been responsible for the preparation of several hundred mobile source air quality studies for projects located throughout the U.S. He has a Master of Science degree in Environmental Engineering and a Master of Science degree in Urban Affairs.

Ping K. Wan
Air Quality Specialist

Ms. Wan prepared the air quality impact sections related to ventilation building emissions of the FSEIS/R. She is an environmental scientist responsible for addressing and resolving air quality issues during the Project planning, design, and construction phases. Her duties also include conducting and performing air quality impact analysis involving both analytical and physical modeling, air quality field monitoring and environmental impact studies. Ms. Wan has 25 years of national and international experience in the field of meteorology and air quality. She holds a Bachelor of Science degree in Physics from the Chinese University of Hong Kong, a Master of Science degree in Natural Science from Pacific Lutheran University, and a Master of Science degree in Physics from Montana State University.

Carl A. Zellner, AICP
Transportation Planning Manager

Mr. Zellner was manager for the transportation chapter for the FSEIS/R and for coordination and preparation of DSEIS/R comment responses. He has 30 years of experience in transportation planning, analysis and research. He holds a Bachelor of Arts degree from Principia College and a Master of Urban Planning degree from the University of Washington and undertook post-graduate studies in City and Regional Planning at Harvard University.

GRAPHICS

Kathe Gregory
Supervisor, Graphics Department

Ms. Gregory supervised the preparation of the graphics in this FSEIS/R and the 1992 NPC. She has had 14 years of experience as an art director, graphic designer and art instructor. She has a Bachelor of Fine Arts degree from Carnegie-Mellon University and a Master of Fine Arts from Rutgers University.

Kathleen Hepburn
DSEIS/R Graphics Coordinator

Ms. Hepburn coordinated the production of all graphics for the FSEIS/R. She has seven years of experience as a technical illustrator and computer consultant. Ms. Hepburn studied mathematics at the University of Colorado, and computer science and graphic production at Northeastern University.

Kathleen Bates
Computer Graphics Specialist

Ms. Bates worked on all phases of graphics on the FSEIS/R. Ms. Bates received a Bachelor of Arts degree in Psychology from the College of the Holy Cross, a Graphic Design Certificate from Massachusetts College of Art, and a Certificate in Advertising from Northeastern University.

Michael Flockhart
Graphic Designer

Mr. Flockhart assisted in the production of the graphics for the FSEIS/R. He has been with the Central Artery/Tunnel Project for five years and holds a Bachelor of Arts in Design Studies from the University of Buffalo.

Rhonda Pearl
Graphic Designer

Ms. Pearl assisted in the production of the graphics for the FSEIS/R. She has an undergraduate degree with highest honors in Fine Arts from S.U.N.Y. College at Oneonta and a Masters of Communications at New York Institute of Technology.

Kelly Simons
Graphic Designer

Ms. Simons assisted in the production of graphics for the FSEIS/R. She has had four years of experience as a graphic designer. Ms. Simons received a Bachelor of Fine Arts degree in Visual Design and a Certificate in Typography, both from Southeastern Massachusetts University.

Carl Twarog
Exhibit Coordinator

Mr. Twarog assisted in the production of the graphics for the FSEIS/R. He attended the Jagiellonian University in Poland, holds a Bachelor of Arts in Design Studies from the State University of New York at Buffalo and is currently pursuing a Masters of Design from Massachusetts College of Art.

Kara Ulrich
Graphic Designer

Ms. Ulrich created and produced graphics for the FSEIS/R. She earned a Bachelor of Fine Arts degree with a concentration in Design from Syracuse University and is currently pursuing a Master Degree from Lesley College.

TEXT, LAYOUT & DESIGN PRODUCTION

Paul E. Orr
Text, Layout, & Design Production

Mr. Orr was responsible for the design of the text layout, as well as supervision of all text production for the FSEIS/R and auxiliary documents. He provided associate editing and proofreading for the FSEIS/R, and created and maintained the database upon which the Comments and Coordination chapter was based. He has several years of experience in both the publishing and computer fields, and holds a Bachelor of Science degree in Anthropology from Hunter College, City University of New York.

Laurie Aurigemma
Layout & Design Production

Ms. Aurigemma worked on desktop layout and design for the FSEIS/R. She has 10 years experience as a graphic designer and photographer. Ms. Aurigemma has an Associate of Science in Desktop Publishing, Graphic Design, and Photography from Bunker Hill Community College.

A. Warren LeNoir
Layout & Design Production

Mr. LeNoir worked on desktop layout and design for the FSEIS/R. He has 8 years experience as a graphic designer and photographer. Mr. LeNoir has an Associate of Science in Desktop Publishing, Graphic Design, and Photography from Bunker Hill Community College. He is currently pursuing his Bachelor of Fine Arts Degree.

THE BSC GROUP, INC.

Rebecca Longley
Assistant Manager, FSEIS/R

Ms. Longley was responsible for coordination of the chapter authors and technical support for the preparation of the FSEIS/R, providing liaison with Graphics and other departments. She coordinated preparation of the Comments & Coordination Section. She also provided quality control review of the aquatic resource chapter and was a member of the Mitigation Task Force. Ms. Longley has over 18 years of experience in environmental permitting and planning, including project management of large highway development projects. Ms. Longley received a Bachelor of Arts in Biology from Nasson College in Springvale, Maine.

Burt Bryan, Ph.D.
Senior Biologist

Dr. Bryan is the NPDES coordinator for Project construction. He prepared the application for the NPDES permit for discharges of groundwater and stormwater resulting from construction, and prepares reports monitoring results obtained under this permit to the appropriate agencies. He also evaluates the Project's wetlands, water quality, and fisheries impacts. Dr. Bryan holds a Bachelor of Science degree and a Master of Science degree in Biology from the University of Vermont, and a Ph.D. in Marine Science from the University of Virginia.

Joseph Freeman
Senior Permitting specialist

Mr. Freeman was responsible for the preparation of the materials disposal section of the FSEIS/R. He previously served as an Associate Environmentalist with the MEPA Unit of the Massachusetts Executive Office of Environmental Affairs. He has 12 years of public and private sector experience in environmental impact assessment. He has a Master of Arts degree in Environmental Policy from Tufts University.

Alan Randall
Senior Environmental Engineer

Mr. Randall prepared the water quality section of the FSEIS/R and the Section 404 (b)(1) Appendix. He was also a member of the Mitigation Task Force. He has 23 years of experience in environmental permitting, including 17 years with the U.S. Army Corps of Engineers. He received a Bachelor of Science degree in Civil Engineering from Worcester Polytechnical Institute.

Joanne Skaliotis
Environmental Scheduler

Ms. Skaliotis was instrumental in tracking the preparation of the chapters of the DSEIS/R and the FSEIS/R. Ms. Skaliotis has over 15 years in project controls, planning and scheduling. Ms. Skaliotis holds a B.S. in Civil Engineering Technology from the University of Massachusetts.

MISTRY ASSOCIATES, INC.

David L. Buhlman, P.E.
Senior Civil Engineer

Mr. Buhlman coordinated the preparation of the Supportive Engineering Report. He has 27 years of experience as a highway and roadway engineer on projects to the Massachusetts Highway Department, and other transportation agencies. Mr. Buhlman holds a Bachelor of Arts degree in Government and Economics from Suffolk University.

FORT POINT ASSOCIATES

Susan St. Pierre
Environmental Planner

Ms. St. Pierre was manager for the wetlands and waterways section of the FSEIS/R and was a member of the mitigation task force. She has 15 years of experience in municipal planning and environmental planning and permitting with the last 5 years focusing on waterfront issues. Ms. St. Pierre has a Bachelor of Science degree in Geography, with specialization in the environment, from Salem State College, and a Master of Arts in Geography, Community, and Regional Planning from Western Illinois University.

WALLACE, FLOYD, ASSOCIATES, INC.

James Purdy
Mitigation Planner

Mr. Purdy coordinated the Final Section 4(f) Evaluation and wrote the open space section of the FSEIS/R. He performed similar roles in the 1985 FEIS/R, the 1991 FSEIS/R, the 1992 NPC, and the 1993 DSEIS/R. He also was a member of the Mitigation Task Force. Mr. Purdy has worked on several transportation related plans and environmental impact documents for the past 16 years while with Wallace, Floyd, Associates, Inc. He holds a Master of City Planning degree from Massachusetts Institute of Technology.

Carole Schlessinger
Mitigation Planner

Ms. Schlessinger was responsible for the land use impacts section of the FSEIS/R. She has 13 years of experience in urban planning, and has been involved in land use and mitigation planning for the Project for 11 years. Ms. Schlessinger holds a Bachelor of Arts in Urban Affairs from Northwestern University and a Masters degree in Community and Regional Planning from the University of Texas at Austin.

Wendy Frontiero
Architect and Preservation Planner

Ms. Frontiero, a registered architect in Massachusetts, prepared the historic resources sections of the FSEIS/R, including the Final Section 4(f) Evaluation. She has a Bachelor of Arts degree from the University of North Carolina at Chapel Hill, a Master of Arts degree in Preservation Studies from Boston University, and a Master of Architecture from the Massachusetts Institute of Technology.

CAMBRIDGE SYSTEMATICS, INC.

Anthony J. DiSarcina, P.E., Principal
Manager, Traffic Forecasting

Mr. DiSarcina managed the preparation of the traffic forecasting analyses and participated in the conceptual design process of alternatives. He has 29 years of experience in transportation planning, traffic engineering and preliminary design and had worked on the 1991 FSEIS/

R. He holds a Bachelor of Science degree in Civil Engineering from Tufts University and a Master of Science degree in Civil Engineering from the University of New Hampshire.

Weili Chen
Associate/Traffic

Mr. Chen prepared the traffic volume and speed data required for the air, noise and ventilation studies and calculated the vehicle miles of travel and vehicle hours of travel. He had worked on the 1991 FSEIS/R. He has 5 years of experience with a Bachelor of Science in Architecture from Tsinghua University in China and a Master in City Planning from Tsinghua University in China and a Master in City Planning from the Massachusetts Institute of Technology.

Joseph Schirripa
Associate/Traffic

Mr. Schirripa managed the traffic assignment process for the expanded study area and worked on the 1991 Projectwide FSEIS/R. He has 11 years of experience with a Bachelor and Master of Arts degrees in Geography from the State University of New York at Buffalo.

Nazrul Islam
Senior Professional Associate/Traffic

Mr. Islam assisted in the preparation of the traffic volume and speed data required for the air, noise and ventilation studies and the vehicle miles of travel and vehicle hours of travel. He has a Bachelor of Science in Civil Engineering from Rajshahi University in Bangledesh, a Master of Science in Transportation Engineering from Concordia University in Canada and a PhD in Transportation Engineering from Utah State University.

Elizabeth Peart
Senior Professional Associate/Traffic

Ms. Peart prepared the data base files of existing traffic count information and assisted in the preliminary analyses of the alternatives. She has 7 years of experience with a Bachelor of Science in Civil Engineering from Carnegie-Mellon Institute and a pending Master of Science in Transportation from Northeastern University.

Katherine Wilkins
Professional Associate/Traffic

Ms. Wilkins assisted in the preparation of the traffic volume and speed data required for the air, noise and ventilation studies and the vehicle miles of travel and vehicle hours of travel. She has 13 years of experience with a Bachelor of Science in Marketing Management from Bentley College.

BOELTER & ASSOCIATES, INC.

Alice Boelter, Principal

Ms. Boelter prepared the navigation section of the FSEIS/R. She has 17 years of experience, including harbor and water transportation issues at Massport. She has a Bachelor of Arts degree in Political Science from Wellesley College and a Master of Arts degree in Public Policy from the University of Michigan.

Donna V. Rosasco
Senior Permitting Specialist

Ms. Rosasco has been involved in permitting for the Artery/Tunnel Project since 1990. She assisted in the preparation of the FSEIS/R and 1991 FSEIS/R sections relating to navigation. She holds a Bachelor of Science degree in Environmental Studies from the University of Massachusetts at Amherst, and a Certificate in Landscape Design from the Radcliffe program in Landscape Architecture.

TIMELINES, INC.

Elena Decima
Vice President/Archaeology

Ms. Decima was the principal archaeological investigator in the extended portion of the Area North of Causeway Street, and prepared the archaeological section of the FSEIS/R. Over a 9-year period, she has served as Field Archaeologist on numerous prehistoric and historic sites. For Timelines, Inc., she has supervised the excavation and analysis of the Boylston Street Fish Weir and has overseen field analysis and report writing on several of historic and prehistoric archaeological sites. In addition, she is an archaeologist a.b.d. in the doctoral program of the University of Pittsburgh.

STULL & LEE

Christopher Procter
Urban Designer

Mr. Procter was responsible for urban design components of the Charles River Crossing. He prepared the FSEIS/R sections on joint development and visual impacts. He has 9 years experience as an architect and urban designer in practice and teaching, for public, private, institutional, and corporate clients, in Australia, New Zealand, and the United States. Mr. Procter holds a Bachelor of Architecture degree from the South Australian Institute of Technology, and a Masters of Architecture in Urban Planning and Design from Harvard University.

KKO ASSOCIATES

Kim Honetschlager
Associate

Ms. Honetschlager assisted in the analysis of traffic volume projections and managed the database that was developed for tracking traffic assignments. Ms. Honetschlager has a Bachelor of Arts from Carleton College in Northfield, Minnesota and is a candidate for a Master of City and Regional Planning at the Kennedy School of Government at Harvard University.

Robert Stoetzel
Associate

Mr. Stoetzel assisted in the development of traffic models for the design alternatives and in the traffic assignment process. He was also involved in the 1991 FSEIS/R. Mr. Stoetzel has a Bachelor of Arts from Merrimack College and a Master of Public Administration from Suffolk University.

9. List Of Agencies, Organizations, And Persons To Whom Copies Of The Statement/Report Were Sent

Chapter 9

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM THE FSEIS/R WAS SENT

The following Federal, State, regional, and local agencies, elected public officials, and other parties were sent copies of this FSEIS/R.

9.1 AGENCIES

Federal Agencies:

- Advisory Council on Historic Preservation
- Center for Disease Control
- Department of Commerce
  - National Marine Fisheries Service
  - National Oceanic and Atmospheric Administration
- Department of Defense
  - Army Corps of Engineers
  - Environment and Safety Office
- Department of Energy
  - Division of NEPA Affairs
- Department of Housing and Urban Development
- Department of Interior
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
- Department of Transportation
  - Federal Aviation Administration
  - Federal Railroad Administration
  - Federal Transit Administration
- Coast Guard
- Environmental Protection Agency
- Federal Emergency Management Agency
- Federal Energy Regulatory Commission
- General Services Administration
- National Trust for Historic Preservation

Regional Agencies:

- Merrimack Valley Regional Planning Commission
- Metropolitan Area Planning Council
- Old Colony Planning Council
- South East Regional Planning and Economic Development Office

State Agencies:

- Office of the Governor, Commonwealth of Massachusetts
- Executive Office of Administration and Finance
  - Division of Capital Planning and Operations
- Executive Office of Communities and Development
- Executive Office of Consumer Affairs and Business Regulation
- Executive Office of Economic Affairs
  - Office of Business Development
- Office of Training and Employment Policy
  - Office of Minority and Women Business Assistance
- Executive Office of Environmental Affairs
  - Coastal Zone Management Office
  - Department of Environmental Management
  - Department of Environmental Protection
  - Department of Fisheries, Wildlife and Environmental Enforcement
  - Division of Marine Fisheries
  - Division of Resource Conservation
  - Massachusetts Environmental Policy Act Unit
  - Metropolitan District Commission
  - Massachussetts Water Resources Authority
- Executive Office of Health and Human Services
  - Department of Social Services
- Executive Office of Public Safety
- Executive Office of Transportation and Construction
  - Central Transportation Planning Staff
  - Massachusetts Aeronautics Commission
  - Massachusetts Bay Transportation Authority
  - Massachusetts Port Authority
  - Massachusetts Turnpike Authority
- Massachusetts Historical Commission
- Massachusetts Office of the Inspector General
- Massachusetts Office of the Attorney General
- Office of the State Auditor, Budget Director

Other States/Agencies:

- City of Honolulu, Hawaii
  - Maine Department of Transportation
  - New Jersey Department of Transportation

Local Agencies:

- Office of the Mayor, City of Boston
- Boston Business and Cultural Development Office
- Boston City Clerk
- Boston Economic Development and Industrial Corporation
  - Office of Jobs and Community Services
- Boston Emergency Medical Services
- Boston Environment Department

- Boston Conservation Commission
- Boston Landmarks Commission

Boston Fire Department
Boston Harbormaster
Boston Health and Hospitals Department
Boston Housing Authority
Boston Inspectional Services Department
    Rodent Control Director
Boston National Historic Park
Boston Office of Neighborhood Services
Boston Parks and Recreation Department
Boston Police Department
Boston Public Facilities Department
    Division of Capital Planning
    Boston Public Works Department
Boston Real Property Department
Boston Redevelopment Authority
Boston Transportation Department
Boston Water and Sewer Commission
Office of the Mayor, City of Cambridge
    Environmental Program
    Community Development Department
    Public Works Department
Cambridge Conservation Commission
Suffolk County Sheriff's Department

9.2 ELECTED PUBLIC OFFICIALS

Federal Legislators:

U.S. Senator Edward M. Kennedy
U.S. Senator John F. Kerry
U.S. Representative Peter I. Blute, 3rd District, Massachusetts
U.S. Representative Barney Frank, 4th District, Massachusetts
U.S. Representative Joseph P. Kennedy II, 8th District, Massachusetts
U.S. Representative Edward J. Markey, 7th District, Massachusetts
U.S. Representative Martin T. Meehan, 5th District, Massachusetts
U.S. Representative J. Joseph Moakley, 9th District, Massachusetts
U.S. Representative Richard Neal, 2nd District, Massachusetts
U.S. Representative John W. Olver, 1st District, Massachusetts
U.S. Representative Gerry E. Studds, 10th District, Massachusetts
U.S. Representative Peter G. Torkildsen, 6th District, Massachusetts

State Legislators:

Senate:

Barrett, Michael J. (Cambridge)
Birmingham, Thomas F. (Chelsea)
Bulger, William M. (Boston)

Havern, Robert A. III (Arlington)
Shan1non, Charles E. (Winchester)
Travaglini, Robert E. (Boston)
Walsh, Marian (Boston)
White, W. Paul (Boston)
Wilkerson, Dianne (Boston)

Committee Chairmen:

Birmingham, Thomas F., Chairman, Senate Ways & Means Committee
Havern, Robert A. III, Chairman, Senate Transportation Committee
Durand, Robert, Chariman, Senate Natural Resources Committee

Finneran, Thomas M., Chairman, House Ways & Means Committee
Karol, Stephen J., Chairman, House Transportation Committee
Angelo, Steven, Chairman, House Natural Resources Committee

House of Representatives:

Brett, James T. (Dorchester)
Ciampa, Vincent (Somerville)
DiMasi, Salvatore F. (Boston)
Draisen, Marc D. (Boston)
Finneran, Thomas M. (Boston)
Fitzgerald, Kevin W. (Boston)
Flaherty, Charles F. (Cambridge)
Fox, Gloria L. (Roxbury)
Gannon, Paul J. (South Boston)
Gardner, Barbara (Holliston)
Garrison, Althea (Boston)
Honan, Kevin G. (Brighton)
Jehlen, Patricia D. (Somerville)
Mannering, Vincent G. (Boston)
McDonough, John E. (Boston)
Owens-Hicks, Shirley (Boston)
Roosevelt, Mark (Boston)
Rushing, Byron (Boston)
Scaccia, Angelo M. (Boston)
Serra, Emanuel Gus (Boston)
Thompson, Alvin (Cambridge)
Twomey, Timothy J., Jr. (Cambridge)
Tracy, Susan (Boston)
Voke, Richard A. (Chelsea)

9.3 LOCAL ELECTED PUBLIC OFFICIALS

Boston City Councillors:

Byrne, James
Kelly, James
Conley, Daniel
McLaughlin, Brian
Davis-Mullen, Margaret
Modica, Diane
Feeney, Maureen
Nucci, John
Hennigan, Maura
O'Neil, Albert
Ianella, Richard
Saunders, Gareth
Kelly, James
Yancey, Chareles
Keane, Thomas

Cambridge City Councillors:

Reeves, Kenneth, Mayor of Cambridge
Russell, Sheila
Duehay, Frank
Born, Kathy
Toomey, Timothy
Walsh, William
Meyers, Jonathan
Sullivan, Michael
Katherine Triantafillou

Somerville Aldermen:

Capuano, Michael E., Mayor of Somerville
Joyce, Kenneth
Cappello, Maryann
O'Dea, Cathleen
Connolly, John
Taylor, Thomas

9.4 ORGANIZATIONS

Libraries:

Boston Public Library
Main Library, 666 Boylston Street
Charlestown Branch, 179 Main Street
Document Receipts
East Boston, 276 Meridian Street

  East Boston, Orient Heights, 18 Barnes Avenue
  Fine Arts, P.O. Box 286, Boston
  Government Documents Section, Copley Square, P.O. Box 286
  Kirstein Business Branch, 20 City Hall Avenue
Boston Public Library
  North End, 25 Parmenter Street
  South Boston, 646 East Broadway
  South End, 685 Tremont Street
  West End, 151 Cambridge Street
Boston Redevelopment Authority Library, Boston City Hall, 9th Floor
Bostonian Society Library, Old State House, 206 Washington Street
Brookline Public Library, 361 Washington Street
Cambridge Public Library
  Main Branch, 449 Broadway
  Boudreau/Observatory Hill Branch, 245 Concord Avenue
  Central Square Branch, 45 Pearl Street
  Collins/Mt. Auburn Branch, 64 Aberdeen Avenue
  Heritage Branch, 48 Sixth Street
  North Cambridge Branch, 70 Rindge Avenue
  Valente Branch, 826 Cambridge Street
Central Artery/Tunnel Project, One South Station, Boston
Chelsea Public Library, 569 Broadway
Concord Public Library, 129 Main Street
Dedham Public Library, 43 Church Street
Federal Highway Administration, 55 Broadway, 10th Floor, Cambridge
John F. Kennedy Library, Columbia Point
  John F. Kennedy Library & Museum
  Kennedy Library
Malden Public Library, 36 Salem Street
Medford Public Library, 111 High Street
Melrose Public Library, 69 West Emerson Street
Milton Public Library, 476 Canton Avenue
Massachusetts Board of Library Commission, 648 Beacon Street, Boston
Massachusetts Institute of Technology (M.I.T.), Barker Engineering Library, Cambridge
  M.I.T. Rotch Library
  M.I.T. Lab for Computer Science Library, 545 Technology Square
Parlin Memorial Library, 410 Broadway, Everett
Revere Public Library, 179 Beach Street
Robbins Library, 700 Massachusetts Avenue, Arlington
Sandwich Public Library, 142 Main Street, Sandwich
Shute Memorial Library, 781 Broadway, Everett
Somerville Public Library, 79 Highland Avenue
South Dennis Public Library, 389 Main Street, South Dennis
State House Library, State House, Boston
State Library of Massachusetts, State House, Boston
State Transportation Library, Transportation Building, 10 Park Plaza
Stoneham Public Library, 431 Main Street
Thomas Crane Public Library, 40 Washington Street, Quincy
Toby Transportation Library, 10 Park Plaza
University of Massachusetts Library, Amherst, MA

Ventress Memorial Library, Library Plaza, Marshfield, MA
Wellesley Free Library, Box 308, Wellesley
Weymouth Public Library, 46 Broad Street
Winthrop Public Library, 2 Metcalf Square

Businesses, Other Organizations, and Individuals:

1000 Friends of Massachusetts
Acentech, Inc.
AFCED-AEQ, Environmental Management
Allen & Company
  Allen, John S.
American Automobile Association
American Consulting Engineers Council of New England
American Lung Association of Massachussets
American Planning Association, Mass. Chapter
Amtrak, Real Estate Division
Anzalone, Joanne Prevost -
  Bridge Design Review Committee (BDRC)
Architects Collaborative
Arrowstreet Inc., Associate
Art Deco Society of Boston
Artery Business Committee
Aserkoff, Janet, Rappaport & Rakov
ASERT
Associated General Contractor
Associated Industries of Massachusetts
ATEX, Inc.
Atlantic Ave. Abutters Group
B&B Oil Company, Rutherford Avenue
Bahne, Charles
Bard, Joel B. - BDRC
Barron, Edward R.
Bay State Financial Services
Bay State Steamship Company
Beacon Hill Civic Association
Bechtel Group, Inc.
Blake, Phoebe
Bluestone, Lawrence H.
Bole, Robert W., III
Boston Area Bicycle Coalition
Boston Business Journal
Boston Chamber of Commerce
Boston District Council of Carpenters
Boston Edison Company
Boston Freight Terminals
Boston Gas Company
Boston Greenspace Alliance
Boston Harbor Associates

Boston Harbor Industrial Corporation
Boston League of Women Voters
Boston Natural Areas Fund
Boston Preservation Alliance
Boston Sand & Gravel Company
Boston Society of Landscape Architects
Boston Society of Architects
Boston Sun Transcript
Boston Thermal Energy
Boston Waterfront Neighborhood Association
Bracken, Thomas
Brad Bellows Architects
Bradley, Peggy and Jim
Braman Dow and Company
Brannen, Robert - BDRC
Breckenridge, Lee - BDRC
Brennan, Gary
Brennan, Judy
Brown Rudnick
Bruce Campbell & Associates
BSC Group
Bunker Hill Community College
Bunker Hill Tenants Task Force
Buonomo, John
Burrington, Stephen - BDRC
Buts, Pamela
Cambridge Chamber of Commerce
Cambridge Citizens for Liveable Neighborhood
Cambridge Community Develop. Dept.
Cambridge Hospital, Department of Medicine
Cambridge Seven Associates
Campbell, Robert
Capola, Joseph
Carangelo, Ferdinand
CARAVAN for Commuters, Inc.
Cardoso, Teresa M.
Carr, Lynch, Hack & Sanderl
Carter, David, Royal Commission
Caruso, Philip J. - BDRC
Casendino & Company
Cashman, Jack
Charles River Park Association
Charles River Park Management
Charles River Watershed Association
Charles River Publishing, Inc.
Charlestown Business Association
Charlestown District Court
Charlestown Historical Society
Charlestown Neighborhood Council
Children's Museum

Cho, Yee
Cipriano, Anthony
Citizens for a Livable Charlestown
Coastal Oil New England
Coleman, Francis
Communitas, Inc.
Conant, Donald R.
Congress Group Ventures
Conrail
Conservation Law Foundation
Consolidated Rail Corporation, PA
Consolidated Rail Corporation, NJ
Constable, William - BDRC
Constitution Marina
Construction Industries of Massachusetts
Conway Inc.
Conway, Dorothy E.
Conway, Jim & Gloria
Cooke-Childs, Lee - BDRC
Cornu Management
Corrigan, Helen
Costa Food Service
CRA
Cunha, Thomas & Marcia
Cushman & Wakefield
D.J.K. Associates
D'Ambrosio, Rose & Anthony
Darling, Marilyn
David Dixon & Associates
Davis, Malcolm Montague
DiLorenzo, George
DiMambro, Antonio - BDRC
DiPasquale, Julie Anne
Dixon, Vince
Donner, Ann - BDRC
Duhamel, Paul
Earls, Michael
East Boston Social Center, Golden Agers
Edwards & Kelcey Inc.
ENSR Consulting & Engineering
Environmental Citizen Organization
Environmental Futures
Environmental Lobby of Massachusetts
Evans, Eric
Favaloro, Joseph, Jr.
Favaloro, Sandra
Federal Reserve Bank of Boston
Fermer, Jim, Jung, Brannen Assoc. Inc.
First Properties, Inc.
Flatley Company

Foley Eliot & Hoag
Frazier, Clark
Freedman, Maurice - BDRC
Friends of Post Office Square
Friends of the Boston Harbor Islands
Frost, Andrew, Associated General Contractors
Gage, William T.
Galvin, Bill
Garver, Richard
Gay, Dorothy
Geraigery, Nicholas
Gifford, K Dun - BDRC
Gifford, Pebble
Gillen, Maurice
Gillette Company
Ginsburg, Arnold
Gleason, Rick - BDRC
Grande, James - BDRC
Graves Landing
Greater Boston Chamber of Commerce
Greater Boston Convention & Visitors Bureau
Greater Boston Community Development
Greenbaum, Mark, Graphic Arts
Guilford Transportation Industries
Gund, Graham - BDRC
Gunwyn Company
Gurel, Ozan
Hale & Dorr
Halfyard, Robert
Halvorson Company
Harvard School of Design
Harvard School of Public Health, Dept. of Environmental Services
Haska, Don
Haymarket Pushcart Association
Heath, Richard - BDRC
Hinkle, Joseph
Historic Neighborhood Foundation
HMM Associates, Inc.
Hoffman, Fenno
Hoffman, Matthew
Hopkinson, Peter - BDRC
Horowitz, Stash
House of Bianchi, Treasurer
HP Hood Inc.
Huang, Kuen Shen, Philadelphia, PA
Iorns, Martin
Jaffe, Eleanor Soherr
Janedy, Nicholas
Johnson, Richard
Jordan Marsh

Jung/Brannen Associates Inc.
Kaiser, Steve
Katz, Jane, c/o Michael Rosenfeld
Kaufman Associates
KEL Design
Kelly, Anne, Red Bank, c/o Janet Young
Kennedy School of Government
Kennedy, Violich Architects
Keohine, Detoure & Keegan
Keyes, Nancy
King, Dan - BDRC
Koty, Stanley, Jr.
Kovacevic, Dan
Kratzmann, Monika
Kruger, Christopher
Kuttner, Bill
Kverik, Rosemary
Labor District Council
Lacerda, Fred, Sullivan Group
Lamb, Bill - BDRC
LaMattina, Sal
Langone, Fred
League of Women Voters - Waltham
Lewis, Louise - BDRC
Liberty Bell Wholesale Grocery
Life Focus Center
Loathell, Thomas
Logue, Edward J.
LoMans, Patricia
MacIver, Donald
Mader, Bernice
Mansfield, James
Marvin, W. Barnes and Jarnis
MASCO
MassPirg
Massachusetts Association of Conservation Commissions
Massachusetts Audubon Society
Massachusetts Bay Marine Studies Consortium (U Mass.)
Massachusetts Business Roundtable
Massachusetts Department of Industrial Accidents
Massachusetts General Hospital
Massachusetts Institute of Technology
Masservy, John - BDRC
Masterman, Culbert & Tully
Mastrangelo, Vito
Matsumiya, Pat
McCarthy, Elaine
McDonald, John, II
McDonough, Kate
McHugh, Steve

McKellar, Brian
McKinnon, Anne
Mercantile Wharf Association
Meredith & Grew
Messervy, John
Mieth, Carolyn
Miller, Harvey S., Commodore, Aleppo Shrine Yacht Club
Miller, Stanley - BDRC
Mintz Levin Cohn Feffis
Mitchell, J. Philip, Construction Industries of Massachusetts
Museum of Science
National Trust
Neff, Elish, Meredith & Grew, Broker
New Boston Garden Corporation
New England Legal Foundation
New England Management Company
New England Telephone Company
Nilsson Associates
North Area Task Force
North Bennett Street School
North End Nursing Home
North End/Waterfront Council
Northeastern University - Snell Library
O'Brien, Marty
Palmer, Gregory
Pangaro, Anthony - BDRC
Panorama Products
Parsons, Brinckerhoff, Quade & Douglas
Paul Revere Memorial Association
Peabody & Brown
Peirce, AIA, John W.
Perk, Jeff
Peter Roudebush & Associates
Peterson, Nancy
Philippi, Eric and Jane
Preston, Katherine M. - BDRC
Prince, Keiko
Prins Recycling
Pugliano, Emilie
Quincy School Community Council
R.M. Bradley & Company, Inc.
Rackemann, Sawyer & Brewster
Rawn, William - BDRC
Redmon, Charles F. - BDRC
Riccioli, Joseph A., Local 82 (Teamsters)
Rizzo Associates, Inc.
Roudebush, Peter - BDRC
Russell, Hugh Adams - BDRC
Salemme, Hugo - BDRC
Sandstead, Vicki Jo - BDRC

Save the Harbor/Save the Bay
Shaeffer, K. H.
Shapiro, Israel & Weiner
Sheinfeld, Peter
Shell Station (Rutherford Ave.)
Sierra Club of New England
Silans, Andy
Smith, McNulty & Kearney
So, Simon
Society for the Preservation of New England Antiquities
Solomon Parking
Sommer, Mark
Sonesta International Hotels
Spaulding, Josiah A.
Spaulding Rehabilitation Hospital
St. John, Ivy
Stillman, Mel
Stone & Webster Engineering
Stone, Ken
Stop & Shop Companies
Stouffer, Caroline
Sullivan, D.F.
Taiwan Area National Freeway Bureau
TAMS
Tecce, Annette
Thideman, Karl
Thompson, Peter - BDRC
Tobin, John
Travaglini, Michael
Twomey, William
Trust for Public Land
Trustees of Reservations
Tuchmann, Robert
Turner, Ginny
U.S. Department of Veterans Affairs
Vanasse, Hangen, Brustlin
Vander Waker, Peter
Vazza Associates
Vendetti, Richard
Vroom, Eileen
Whelan, Jack & Ellen
Winiger, Jim
Wofford, John - BDRC
Zarrilli, Vincent F.
Zimmerman, Robert - BDRC
Zupancic, Ernest - BDRC

10. List Of Abbreviations

Chapter 10
LIST OF ABBREVIATIONS

AAQS	Ambient Air Quality Standards (Federal and State)
AASHTO	American Association of State Highway Transportation Officials
AWDT	Average weekday daily traffic
BDRC	Bridge Design Review Committee
BFD	Boston Fire Department
BHCC	Bunker Hill Community College
BLC	Boston Landmarks Commission
BLSF	Bordering lands subject to flooding
BRA	Boston Redevelopment Authority
BSG	Boston Sand & Gravel Company
BTD	Boston Traffic Department
Btu	British thermal unit
BVW	Bordering vegetated wetlands
BWSC	Boston Water and Sewer Commission
CAAA	Clean Air Act Amendments of 1990
CAD	Confined aquatic disposal
CANA	Central Artery North Area Project (i.e., I-93/Route 1 Interchange in Charlestown)
CARLTF	Central Artery Rail Link Task Force
CERCLA	Comprehensive Environmental Response, Comprehensive Liability Act
cfs	Cubic feet per second
CIP	Committee Improvement Package (name used by BDRC for different design options)
CO	Carbon monoxide
CSO	Combined sewer overflow
cy	Cubic yards
CZM	Coastal Zone Management
dBA	A-weighted decibel (a noise measurement)
DCPO	Department of Capital Planning and Operations (State)
DEP	Department of Environmental Protection (State)
DSEIS/R	Draft Supplemental Environmental Impact Statement/Report (1993)
DWPC	Division of Water Pollution Control (State)
EDA	Economic development area
EOEA	Executive Office of Environmental Affairs (State)
EOTC	Executive Office of Transportation and Construction (State)
EPA	Environmental Protection Agency (Federal)
FAR	Floor area ratio
FEIS/R	Final Environmental Impact Statement/Report (1985)
FHWA	Federal Highway Administration
FSEIS/R	Final Supplemental Environmental Impact Statement/Report (1991)
FTA	Federal Transit Administration
GEP	Good engineering practice
HC	Hydrocarbon
HOV	High-occupancy vehicle
in/sec	inches per second
L eq	Equivalent noise level
LEPC	Local Emergency Planning Committee (Boston)
lf	Linear foot
LOS	Level of service (traffic)
LUW	Lands under water
MAC	Massachusetts Aeronautics Commission
MBDS	Massachusetts Bay Disposal Site
MBTA	Massachusetts Bay Transportation Authority
MDC	Metropolitan District Commission
MEPA	Massachusetts Environmental Policy Act
MGH	Massachusetts General Hospital
MHC	Massachusetts Historical Commission
MHD	Massachusetts Highway Department
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	Miles per hour
MPO	Materials Processing Operation

MTA	Massachusetts Turnpike Authority
MWRA	Massachusetts Water Resources Authority
NAC	Noise Abatement Criteria (FHWA)
NATM	New Austrian Tunnel Method (construction)
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxide
NPC	1992 Notice of Project Change for Revised Charles River Crossing (i.e., Alternative 8.1D Modified 5)
NPDES	National Pollution Discharge Elimination System
NS	Non support
NWS	National Weather Service
O_3	Ozone
OLM	Ozone Limiting Method
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PHC	Petroleum hydrocarbon
PM_{10}	Particulate matter smaller than or equal to 10 microns
ppm	Parts per million
PSD	Prevention of Significant Deterioration
PVF	Principal Value Functions
PWWMP	Projectwide Wetlands and Waterways Mitigation Program
RCRA	Resources Conservation Recovery Act
ROW	Right-of-way
sec/veh	Seconds per vehicle
SEIS/R	Supplemental Environmental Impact Statement/Report
sf	Square foot
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan (for air quality)
TDC	Transcontinental Development Corporation
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
v/c	Vehicle to capacity ratio
VHT	Vehicle hours of travel
VMT	Vehicle miles of travel
VOC	Volatile organic compound
vph	Vehicles per hour
WET	Wetlands Evaluation Technique
$\mu g/m^3$	Micrograms per cubic meter

Final Section 4(f) Evaluation

FINAL SECTION 4(f) EVALUATION

1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF THE FINAL SECTION 4(f) EVALUATION

The information and evaluation provided here supports the Federal Highway Administration's (FHWA) determination under Section 4(f) of the Department of Transportation Act of 1966 regarding the Charles River Crossing. This determination is made after selection of a Preferred Alternative in the FSEIS/R. Section 4(f) is a Federal law which strongly protects significant public parklands and historic resources from impairment by transportation projects. Only where a project proponent affirmatively demonstrates that there is no feasible and prudent alternative is any use of a public park or historic property allowed. If such parkland or historic impacts are unavoidable, Section 4(f) ensures that project design and mitigation measures will minimize or compensate for these impacts.

This evaluation addresses the 4(f) impact of the Preferred Alternative and two other new design alternatives for the Charles River Crossing in the Area North of Causeway Street, compares them to the impacts of the 1991 FSEIS/R Proposed Action (Scheme Z), and discusses proposed mitigation in order to demonstrate all possible planning to minimize harm. Parkland mitigation appropriate to these alternatives is discussed in the context of 4(f)-protected parkland in the Area North of Causeway Street. Open space which is not parkland, and which is therefore not subject to Section 4(f), is addressed in Section 4.2.2 of this FSEIS/R.

Please note that the discussion on air quality and noise impacts on 4(f) resources are based on the alternatives analysis of all four designs in the 1993 DSEIS/R. It is not based on updated predictions for only two designs, the Preferred Alternative and Scheme Z, which are reported in Sections 4.1, 4.2, and 4.3 of this FSEIS/R. The updated traffic results are based on an expanded street network since the 1993 DSEIS/R. Changes in air quality and noise impacts using this expanded traffic network are negligible.

2 COORDINATION

The Metropolitan District Commission (MDC) has jurisdiction over parklands along the Charles River which are affected by the Charles River Crossing. Pursuant to the Massachusetts Highway Department's (MHD) mitigation commitments in the 1991 FSEIS/R for the entire Central Artery/Tunnel Project (the Project), MHD and MDC executed a Memorandum of Agreement (MOA) regarding implementation of park mitigation measures for the 1991 Proposed Action in the Area North of Causeway Street, beginning with funding of MDC parkland master planning for the area.

The MDC master plan is now substantially complete. The master plan reflects the park agency's objective of creating a continuous riverfront park and pedestrian pathway system between the old and new Charles River Dams, and it describes the potential future uses, values, and functions that were documented in the 1991 FSEIS/R.

In addition, the MDC master plan proposes a series of detailed park design concepts and programming initiatives for future MDC action. The details of the master plan are, accordingly, not part of this Section 4(f) Evaluation; however, as further described below, MHD remains committed to coordinating with the MDC throughout Project development and construction, to facilitate realization of the MDC's overall vision for the Charles River Basin parkland system. For example, the design of landscape improvements to the north bank portion of Paul Revere Landing Park is imminent; these improvements will be funded by MHD as part of overall mitigation for the Charles River Crossing.

During the preparation of this Section 4(f) Evaluation, MHD met with the MDC staff to reach agreement on the characterization of planned park use, how the alternatives would affect planned use, and refinement of plans for minimization of harm which are consistent with the MOA mitigation plans, but including specific adjustments for the Preferred Alternative.

Coordination continued prior to the Final Section 4(f) Evaluation, focussing on appropriate mitigation for the

Preferred Alternative. Representatives of the Massachusetts Executive Offices of Environmental Affairs (EOEA) participated along with MDC in these discussions with the objective of integrating wetlands/waterways (water resource) mitigation with parklands mitigation. An Amendment and Restatement of the 1991 MOA between MDC and MHD resulted from these discussions.

The 1993 MOA is appended to this Section 4(f) Evaluation.

The MDC's December 30, 1993, letter to MHD (which is referred to below) addresses the consistency of their master plan objectives with the Preferred Alternative and the role of the proposed mitigation in implementing these master plan objectives. The mitigation measures are described in Section 2.8 of this 4(f) Evaluation and in Chapter 6 of this FSEIS/R.

Bunker Hill Community College (BHCC) athletic facilities were previously affected by Ramp C-L which was common to all three new design alternatives described in the DSEIS/R. MHD met with BHCC officials and the Massachusetts Higher Education Coordinating Council regarding the use of these facilities, and investigated potential refinements to avoid them. These efforts were successful, and accordingly, the ramp has been shifted out of BHCC property. The athletic facilities are not affected by the Preferred Alternative.

MHD has coordinated with the National Park Service (NPS) regarding development of the Project since its inception, and has discussed the Draft Section 4(f) Evaluation with NPS. In addition, MHD has worked with NPS to facilitate visitor access via the Central Artery to the U.S.S. Constitution and other NPS facilities in the Charlestown Navy Yard and on the Freedom Trail in downtown Boston. These facilities are not affected by the Charles River Crossing alternatives.

Historic and archaeological resources protected by Section 4(f) are the subject of ongoing regular meetings with the Massachusetts Historical Commission (MHC, the State Historic Preservation Officer) and Boston Landmarks Commission pursuant to the Section 106 Memorandum of Agreement. MHD has met weekly with these agencies and with the Cambridge Historical Commission to discuss the inventory of historic and archaeological resources potentially affected by the Charles River Crossing alternatives, the effect of the alternatives on the resources, and measures to minimize harm. Coordination is ongoing regarding the implementation of the mitigation plan for the Charles River Crossing.

During the preparation of this FSEIS/R, specific consultation with MHC regarding the progress of ongoing archaeological studies and the details of impacts on historic resources has taken place. MHC's input regarding historic and archaeological resources is reflected in Section 4 of this 4(f) Evaluation, below. A copy of MHC's December 9, 1993, letter concurring with the process for ongoing archaeological studies is also appended to this 4(f) Evaluation.

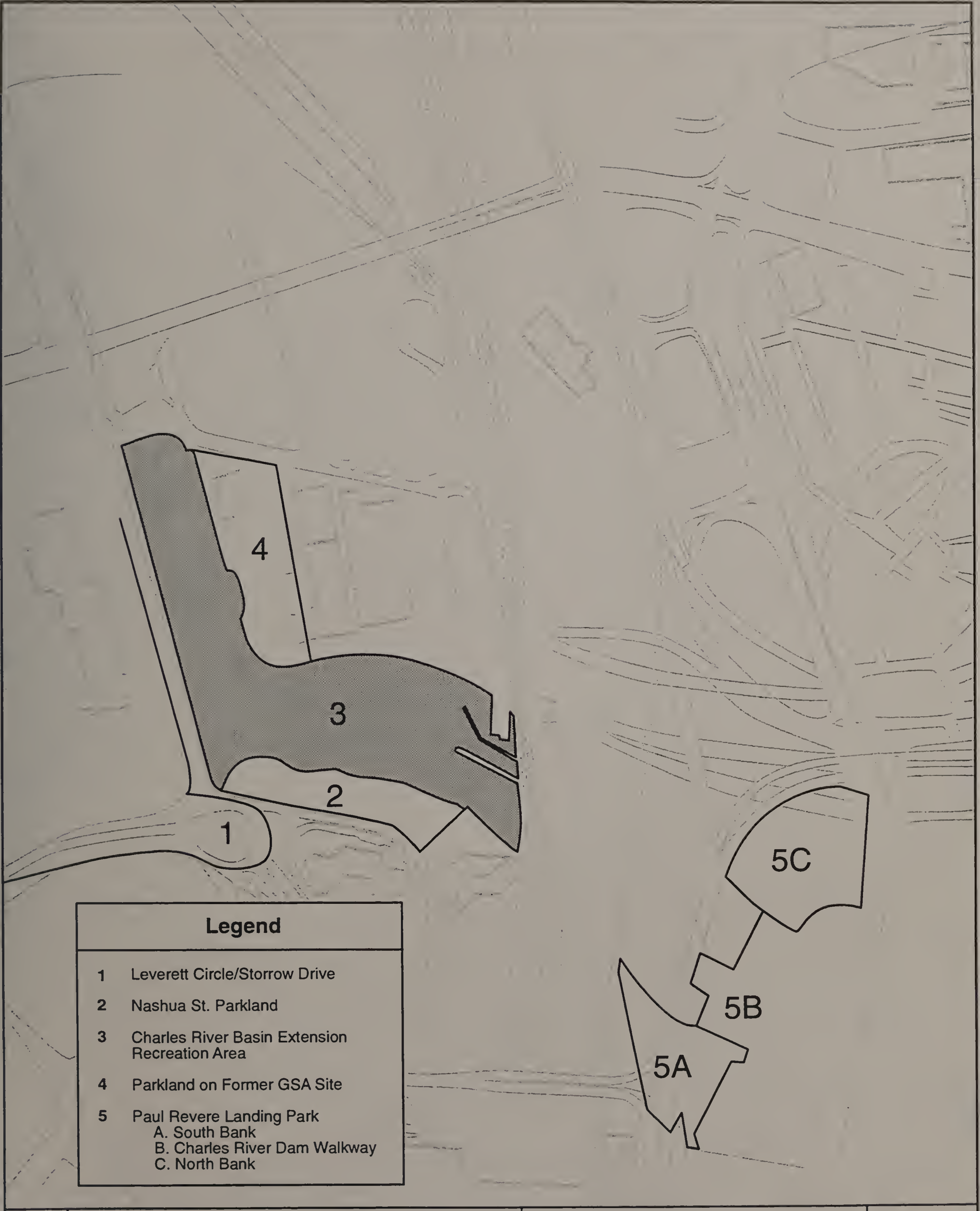
3 PARKLANDS

The MDC is the regional agency which owns and manages the Charles River Basin, the old and new Charles River dams and navigation locks, and various land and water parcels associated with the Charles River Reservation. Five MDC parkland parcels are identified as Section 4(f) resources in the Area North of Causeway Street: Leverett Circle/Storrow Drive (part of the Charles River Esplanade); proposed Nashua Street parkland and Spaulding walkway; the existing Charles River Basin Extension Recreation Area; proposed parkland at the former GSA site, where the MDC central services facility is located; and existing Paul Revere Landing Park, north and south bank portions (see Figure 1).

All alternatives for the Charles River Crossing, including the Preferred Alternative, use land in Paul Revere Landing Park and the Leverett Circle portion of the Charles River Reservation, and all alternatives result in visual and noise impacts on the three other MDC parcels. The MDC park properties and impacts to them are described below individually. Since these properties are intended to function in the future as a system, park properties and impacts to them are also discussed as a system.

As noted above, in the Preferred Alternative , Ramp CL has been relocated farther north, near Sullivan Square thereby avoiding impacts to where no 4(f) resources at BHCC.

All comparisons in the following sections relate to Scheme Z, except where one new alternative is explic-



Legend

1 Leverett Circle/Storrow Drive

2 Nashua St. Parkland

3 Charles River Basin Extension Recreation Area

4 Parkland on Former GSA Site

5 Paul Revere Landing Park
    A. South Bank
    B. Charles River Dam Walkway
    C. North Bank

FIGURE

1

Section 4(f) Parkland Resources In Lower Charles River Basin

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 100 200 300 400 500 FEET

itly compared to another.

3.1 SCHEME Z AND NEW DESIGN ALTERNATIVES CONSIDERED IN THE 1993 DSEIS/R

The Preferred Alternative (called the Non-River-Tunnel Alternative in the DSEIS/R) has a 10-lane long-span bridge, a four-lane, medium-span, single-deck Storrow Drive connector bridge with the same profile as the mainline bridge, no river tunnel, a ventilation building for land-based tunnels south of the river, and three ramps merging to two loop ramps 35 to 40 feet high and set back 140 feet from the river's edge. (For purposes of this 4(f) Evaluation, these measurements give the distance from the river's edge at the point closest to the relevant 4(f) parkland resource.) Refinements with 4(f) consequences since the DSEIS/R include the relocation of the Nashua Street off-ramp, avoiding the Nashua Street park parcel, and relocation of the Rutherford Avenue off-ramp (Ramp CL), avoiding the BHCC athletic fields. Three other design refinements have been incorporated into the Preferred Alternative (see Chapter 2 of this FSEIS/R), but do not affect the 4(f) parkland resources identified above.

Scheme Z includes two five-lane long-span bridges and one six-lane, medium-span, double-deck bridge over the Charles River, a two-way double-deck viaduct behind North Station connecting to Leverett Circle, and an interchange on the north bank of the river consisting of six nested loop ramps up to 105 feet high and tangent to the river's edge.

Alternative 8.1D Mod 5 has a single 10-lane long-span bridge, a three-lane river tunnel with a ventilation building on the south side of the river, and a single loop ramp 35 to 40 feet high and 180 feet from the river's edge.

The Reduced River-Tunnel Alternative has a single 12-lane long-span bridge, a two-lane river tunnel with a ventilation building on each side of the river, and two loop ramps 35 to 40 feet high and 140 feet from the river's edge. Since the DSEIS/R, a refinement to this alternative was developed, realigning its river tunnel downstream of the railroad crossing away from the recreational portion of the Charles River. The eastbound underpass at Leverett Circle has been realigned and is shallower than in the unrefined version; the mainline bridge is identical in both versions. Loop ramps in the refined version are identical to those of the Preferred Alternative, with three ramps merging into two as opposed to the unrefined version with two ramps and a boat section closer to the river. See Section 2.4.4(c) in the FSEIS/R for description of this design refinement. The implications of the realigned version are contrasted to the earlier version where applicable in the following sections.

3.2 LEVERETT CIRCLE/STORROW DRIVE (CHARLES RIVER ESPLANADE)

Description Of Section 4(f) Property. The Leverett Circle/Storrow Drive intersection is an area of approximately 1 acre lying within the southeastern boundary of the historic Charles River Reservation, a 1,000-acre public parkland including the Charles River and land on both sides of the river between the old Charles River Dam (O'Brien Highway) and Watertown to the west. The Boston portion of the Reservation lying between Storrow Drive and the Charles River is called the Esplanade. The portion of the Esplanade park near Leverett Circle is heavily used and contains a pedestrian/bicycle path, a swimming pool, a wading pool, a baseball field, a football/soccer field, a tot-lot, and, closest to the Project area, two tennis courts. Historic buildings at the MDC dam including one currently housing a State Police station, and a parking area are located adjacent to Leverett Circle.

Although Storrow Drive was developed as a riverside parkway within the Charles River Reservation, its terminus at Leverett Circle has been modified over the years to accommodate heavy general traffic volumes. Leverett Circle is a landscaped traffic rotary at the intersection of Storrow Drive, O'Brien Highway, Nashua Street, Lomasney Way, Martha Road, and the approach ramps to the Central Artery (see Figure 2). The Green Line Science Park light rail transit station owned by the MBTA is located on an elevated structure that bisects the Circle. Two pedestrian bridges over Storrow Drive and Leverett Circle link the station with the Charles River Park private housing development and the Charles River Esplanade riverside park. Pedestrian access to the approximately 28,000-square-foot grassy area within the Circle is not available as it would be unsafe to cross the heavily traveled roadway that surrounds it. Peak hour traffic volumes on Storrow Drive, Nashua Street, and O'Brien

Highway that feed into Leverett Circle are among the highest in downtown Boston. A westbound two-lane underpass at Leverett Circle carries traffic from I-93 and the Tobin Bridge to Storrow Drive, and two surface lanes run between the underpass and the Esplanade. Eastbound, there are four surface lanes on Storrow Drive to provide traffic storage capacity at the Leverett Circle traffic signal. The south sidewalk and planting strip along Storrow Drive runs roughly parallel to the Esplanade but separated from it by eight lanes of traffic. It serves general pedestrian circulation and provides access to the Esplanade via overpasses used by pedestrians and bicyclists. There are opportunities for landscaping on both sides of the highway boat sections in all alternatives, and a new landscaping scheme for Storrow Drive and Leverett Circle is possible in all alternatives.

Farther south from Leverett Circle is another pedestrian overpass at Blossom Street linking Charles River Park over Storrow Drive and the Esplanade. This area lies within the Charles River historic district, which is addressed below under Historic Resources.

Impacts On Leverett Circle/Storrow Drive By Scheme Z And New Design Alternatives. Scheme Z and all of the new alternatives reconfigure the Leverett Circle intersection, with some areas of roadside landscaping converted to pavement and other areas converted from pavement to landscaping. After reconfiguration, there is a net decrease in parkway landscaping in all alternatives.

The alternatives differ in land areas affected as follows:

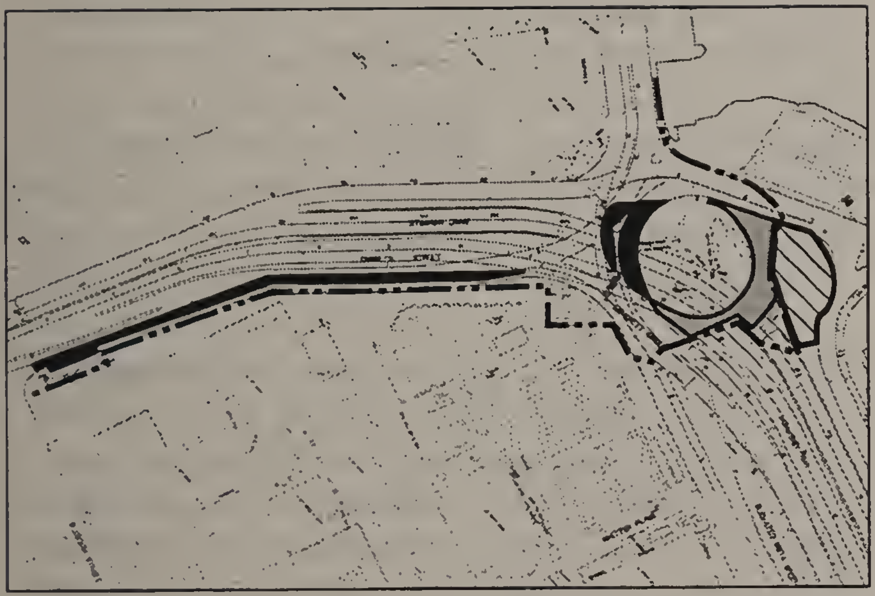
Alternatives	Preferred Alternative	Scheme Z	8.1D Mod 5	Reduced River-Tunnel
Landscaping to Pavement (acres)	0.46	0.44	0.3	0.55
Pavement to Landscaping (acres)	0.13	0.13	0.12	0.08
Net Decrease (acres)	0.33	0.31	0.18	0.47
Addional Land Added (acres)	0.15	0.27	0.1	0.12
Overall Impact (acres)	-0.18	-0.04	-0.08	-0.35

These changes alter the appearance of Leverett Circle and reconfigure the intersection and adjacent landscaping by removing the grass, shrubs, and trees within the Circle. Scheme Z, the Reduced River-Tunnel Alternative, and the Preferred Alternative appear similar in this area from the pedestrian's point of view, as all have eastbound underpasses located next to the existing westbound underpass, and thus require the widening of Storrow Drive on the side opposite the Esplanade. In the DSEIS/R, the eastbound underpass of the Reduced River-Tunnel crossed under the westbound underpass; under the proposed refinement of the Reduced River-Tunnel, the underpasses are parallel in this alternative and therefore essentially the same as in the Preferred Alternative. (Provision of a storage lane for left turns at Leverett Circle similarly shifts the eastbound boat section of Scheme Z to the west, making it similar to these new alternatives.) The current appearance of the area is changed less in Alternative 8.1D Mod 5, which does not have an eastbound boat section and underpass; however, in this alternative this portion of Storrow Drive would be noticeably more congested, particularly during peak hours when heavy commuter volumes use this roadway. Storrow Drive cannot currently be crossed at grade in this area, so the widening in any of the alternatives has no effect on access to the Esplanade from the south sidewalk and the MBTA station. (Pedestrian bridges will be reconstructed in place.) None of the alternatives directly affects the adjacent Esplanade, as the existing westbound curbline next to the Esplanade is unchanged in all alternatives.

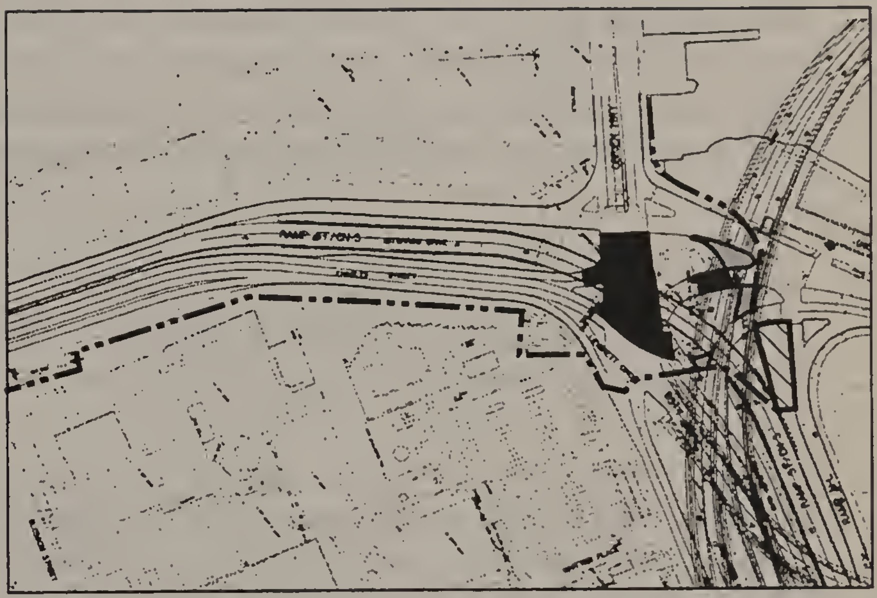
Noise modeling shown in the 1993 DSEIS/R indicates that all three new alternatives result in marginal noise increases at the pedestrian overpass at Leverett Circle. Increases over Scheme Z are 2 dBA for Alternative 8.1D Mod 5, 2 to 3 dBA for the Reduced River-Tunnel Alternative, and 2 to 4 dBA in the Preferred Alternative. (Increases of 3 dBA are not perceptible by most people.) Total noise in the year 2010 at this busy intersection is 74 to 76 dBA, compared to 70 to 73 dBA today. Modeling results at locations in the Charles River Park apartment complex west of the intersection and farther from the roadway are more indicative of noise levels within the Esplanade. At these residential receptors, noise increases by 1 to 2 dBA in Alternative 8.1D Mod 5, and noise is lower in the Reduced River-Tunnel and Preferred Alternatives by 1 to 2 dBA as compared to Scheme Z; these changes are not perceptible by most people. (These results are presented in Section 4.4, Noise and

Legend

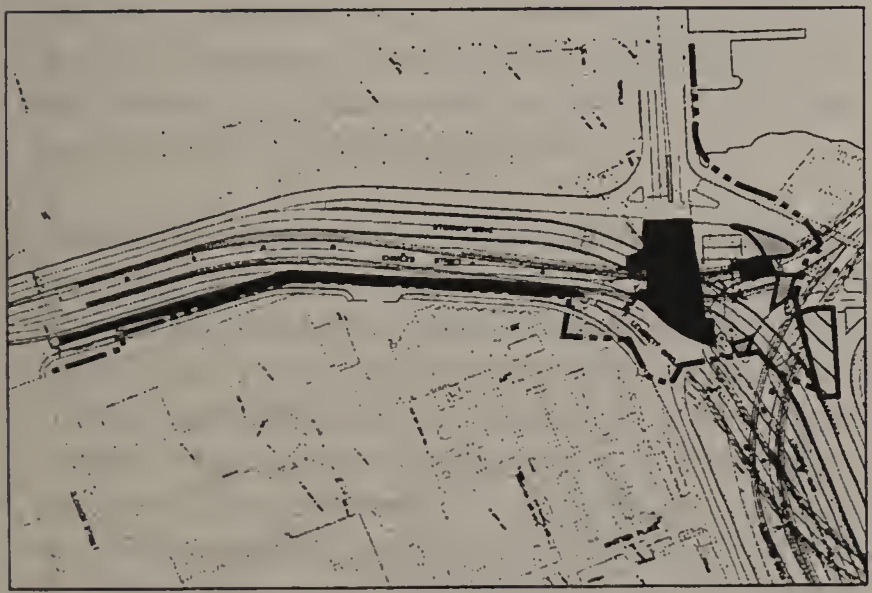
- ■ Landscape to Pavement
- ▭ Pavement to Landscape
- ▧ Landscaped Area Added to Property
- —··· Property Line



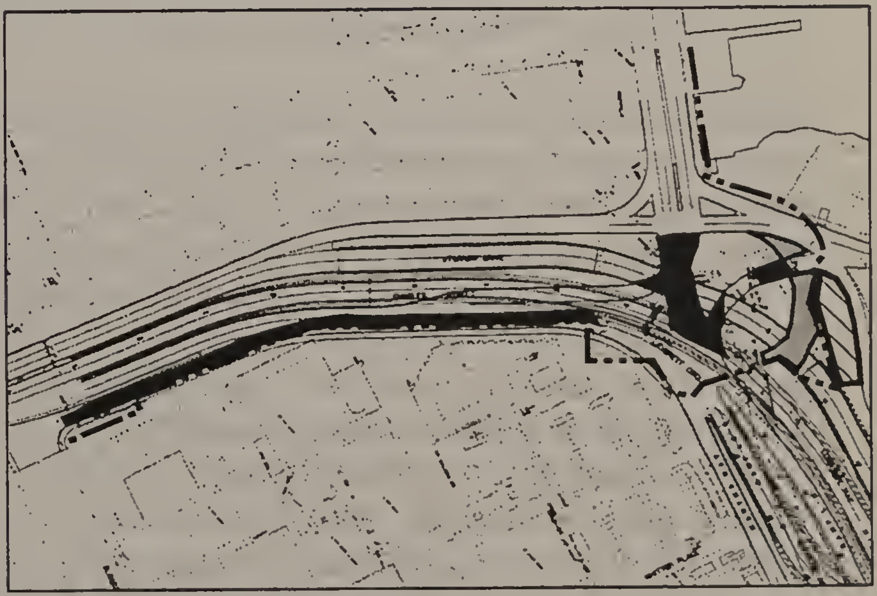
Scheme Z



Alternative 8.1D Mod 5



Reduced River-Tunnel Alternative



Preferred Alternative

FIGURE

2

Use Of Section 4(f) Resource: Leverett Circle And Storrow Drive

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

Vibration of the 1993 DSEIS/R.)

Air quality at Leverett Circle is worse in Alternative 8.1D Mod 5 than for Scheme Z . One-hour CO concentrations increase in the year 2010 from 10.4 ppm to 11.7 ppm, and 8-hour concentrations increase from 6.2 to 7.0 ppm. Air quality is improved in the Reduced River-Tunnel Alternative and Preferred Alternative. One-hour concentrations in the year 2010 decrease from 10.4 to 9.2 and 9.7 ppm, respectively, with these new alternatives, and 8-hour concentrations decrease from 6.2 to 5.5 and 5.8 ppm, respectively. The Preferred Alternative results in the larger decline in CO concentration in each case. (Refer to Section 4.3, Air Quality in the 1993 DSEIS/R, for a discussion of these results.)

During construction, Scheme Z affects traffic in the Leverett Circle intersection and requires the reconstruction of pedestrian overpasses providing access to the Esplanade at Blossom Street and at Leverett Circle (via the Green Line Science Park station). Construction is staged to maintain one of these pedestrian overpasses at all times. There is no direct construction period impact on the Esplanade park or temporary use of land from the Esplanade playground. All of the alternatives to Scheme Z likewise require staged reconstruction of pedestrian overpasses. None of these alternatives has direct impacts on the Esplanade park or temporarily uses land from the Esplanade playground.

Avoidance Alternatives. As discussed in the 1991 Section 4(f) Evaluation, connection of highway facilities to Storrow Drive is a principal objective of the Central Artery/Tunnel Project. Therefore, changes in the Leverett Circle intersection cannot be avoided. A refinement was studied which would substitute a single, two-way underpass at Leverett Circle to consolidate the eastbound and westbound boat sections with the goal of reducing the extent of Storrow Drive affected by the underpasses. These studies concluded that the refinement was unsuccessful in that its goal could not be met without encroaching into the Esplanade and thereby increasing the amount and severity of use of the 4(f) resource. Alternative 8.1D Mod 5 changes the intersection to a lesser extent than the other alternatives, but consequently does not result in acceptable traffic conditions at the intersection (see Section 4.1 of this FSEIS/R). Additional design refinements described in the DSEIS/R attempted to refine the Leverett Circle intersection in Alternative 8.1D Mod 5. These refinements require modification of Storrow Drive to a level similar to the other alternatives, and would require demolition of the historic Registry building (100 Nashua Street) and the use of a portion of the Nashua Street parkland parcel, 4(f) resources; therefore, this refinement would not reduce harm to Section 4(f) properties.

Conclusion. Based on the above, there is no feasible and prudent alternative to the use of land from Leverett Circle and Storrow Drive. The Preferred Alternative includes all possible planning to minimize harm to this property resulting from such use, as described in Section 3.8, below.

3.3 CHARLES RIVER BASIN EXTENSION RECREATION AREA

Description Of The Section 4(f) Resource. The portion of the Charles River between the old MDC dam and the MBTA railroad bridge was designated by the MDC in 1990 as a water recreation area to be developed for active recreational boating and park uses. This water recreation area is administered by the MDC as a part of the Charles River Reservation, and is also referred to as the "new Charles River Basin upstream area."

This section of the river is part of the extended Charles River Basin which resulted from construction of the new MDC dam in 1978. The new MDC dam replaced the old dam at Science Park which was no longer able to contain major floods.

The MDC manages the Basin extension and the new dam for multiple purposes including navigation, flood control, water quality protection, and fisheries restoration. The locks at the new dam serve substantial numbers of recreational, and some commercial, boats passing between Boston Harbor and the Charles River.

The MDC's designation of the upstream portion of the Basin extension, between the old dam and the railroad bridge (see Figure 1 for boundaries), for recreational boating and park purposes reflected changes in this river area following the approved Projectwide 1986 FEIS/R, and planning considerations supporting significant recreational activity in the near-term future. Recreational boaters have access into this area: (1) through the twin bascule railroad bridges, which is raised for passing boats on weekdays when commuter railroad service is frequent, and left in an open position most times on weekends, except when closed to allow for passage of less frequent trains; and (2) through twin draw bridges at the O'Brien Highway at the old dam which are also operated to allow boat passage.

Between the old dam and the railroad bridge, there is an expanse of open water suitable for recreational boating without interference with boats passing between the dams. While not as wide as it is upstream along the Esplanade, the river in this area is consistently 350 to 450 feet wide and over 1,150 feet long from the old dam to the railroad bridge. Recreational boating in this area is planned by the MDC to be similar to the active recreational uses that have taken place for the past 75 years on the Charles River above the old dam. The MDC master plan proposes a dock facility at the former GSA parcel for canoes and paddle boats which would use this section of the river.

Impacts On Charles River Basin Extension Recreation Area By Scheme Z And New Design Alternatives. Scheme Z has no river tunnel and thus avoids direct use of this portion of the Charles River. This area is adversely affected, however, by the views and noise of its six densely nested loop ramps on the north bank, rising to 105 feet in height, extending to within 45 feet of the granite wall bounding the river; the double-deck Storrow connector bridge located 150 feet downstream from this portion of the river also has visual impacts. No shadow impacts extend this far upstream, however. The 1991 Section 4(f) Evaluation concluded that visual impacts adversely affect the Charles River Basin Extension Recreation Area but do not constitute constructive use of this urban recreational resource. It was noted in the 1991 Final Section 4(f) Evaluation that large-scale highway ramps and bridges are major elements in views from the river. While perhaps tolerable in an urban setting, these impacts are typical of those which prompted numerous public comments and resulted in the restudy of Scheme Z, leading to the three new alternatives studied in the DSEIS/R and in this Section 4(f) Evaluation. It is also noted that the visual setting of the MDC parkland is an important contributor to the value of each parcel and to the system as a whole.

The Preferred Alternative and other new alternatives substantially reduce visual impacts by reducing the number and height of loop ramps on the north bank of the river and increasing their setback from the river. Noise is marginally reduced by the greater distance to highway structures and by the use of land-based and, in some alternatives, river tunnels, for a portion of the traffic which crosses the river on viaduct in Scheme Z. (See Section 4.4, Noise and Vibration.)

In Alternative 8.1D Mod 5, there is a single loop ramp 35 to 40 feet high and 180 feet from the bank of the river. The highway bridge is 305 feet downstream, beyond the railroad bridge. An above-ground ventilation structure with exhaust-air discharge stacks is located 100 feet from the south riverbank, near the corner of the Nashua Street park parcel, but located outside this resource.

In the Reduced River-Tunnel Alternative, a pair of 35 to 40-foot high loop ramps is set back 140 feet from the north bank of the river. The realigned version is essentially identical to the Preferred Alternative on the north bank. Refined and unrefined versions have a similar appearance from the river. The highway bridge is 290 feet downstream, beyond the railroad bridge. A below-ground ventilation structure with exhaust-air discharge stacks is located approximately 560 feet south of the riverbank and has no direct effect on the Charles River Basin Extension area. As refined since the DSEIS/R, the river tunnel in this alternative has been relocated downstream of the railroad bridge and thus has no construction impact on the upstream portion of the river. The refinement does have, however one large ventilation building above grade, similar to 8.1D Mod 5. The building is also outside this resource.

Construction period impacts to park use are substantial in Alternative 8.1D Mod 5 and in the Reduced River-Tunnel Alternative without the realignment refinement. Alternative 8.1D Mod 5 requires construction of a river tunnel, which is highly disruptive to park use, for a period of 3 to 4 years. Construction involves placement of caisson-supported sheet pile barriers, dredging between these barriers, placement of prefabricated tunnel tube sections, and covering the immersed tubes. Major pieces of construction equipment such as cranes and dredges are placed on barges in this portion of the river. This work is staged to allow navigation between the old MDC dam and the bascule railroad bridge. On the north bank of the river there is a casting basin for fabrication of tube sections. Recreational boats are able to pass through this segment of the river during construction operations, but boats are not permitted to remain near the construction operations and the setting is not suitable for water-based recreation during tunnel construction (see Section 5.1.2).

The Preferred Alternative avoids the direct impact resulting from tunnel construction under the designated recreational portion of the Charles River. Two 35- to 40-foot high loop ramps (having merged from three ramps well north of the river) are set back 140 feet from the north bank of the river. A single-deck Storrow Drive connector bridge is located 170 feet downstream, beyond the railroad bridge, but computer-generated perspective studies indicate that this bridge would be a visual improvement over the double-deck bridge in Scheme Z (see Figures 3 and 4). A below-ground ventilation structure with exhaust-air discharge stacks is located approximately 630 feet south of the riverbank and has no direct effect.

The Preferred Alternative has no construction impact on the Charles River Basin Extension Recreation Area.

Avoidance Alternatives. The Preferred Alternative avoids any use of the resource, as do Scheme Z and the realigned refinement to the Reduced River-Tunnel Alternative. In Alternative 8.1D Mod 5 and the Reduced-River Tunnel Alternative, it is impossible to avoid the Charles River Basin Extension Recreation Area, which lies directly between Leverett Circle and the Tobin Bridge, which the tunnel must connect.

Conclusion. Based on the above, there is no permanent use or temporary use of the Charles River Basin Extension Recreation Area by the Preferred Alternative.

3.4 NASHUA STREET PARK/ SPAULDING WALKWAY

Description Of Section 4(f) Property. Pursuant to the Chapter 91 License for construction of the new Suffolk County Jail, the State Division of Capital Planning and Operations transferred to the MDC a riverfront parcel of approximately 100,000 square feet, adjacent to Leverett Circle and the relocated Nashua Street (the Nashua Street Park). The new land acquisition extends the Charles River Esplanade approximately 800 feet to the east of the O'Brien Highway. Completion of park improvements requires the relocation of an existing helipad, which under the existing terms of the Chapter 91 license must be relocated no later than December 31, 1994. This parcel has not yet been developed, and there is no current park use of the parcel.

Adjacent to the Nashua Street parcel is a wooden walkway 12 feet wide and extending 210 feet along the Charles River on a seawall to the edge of the privately owned Spaulding Rehabilitation Hospital property (the Spaulding Walkway). Under a joint agreement with the MDC and Spaulding Hospital, the MBTA constructed the wooden walkway on the seawall behind Spaulding Hospital and conveyed the walkway to the MDC. Spaulding Hospital retained access rights and is to construct a pile-supported pier on the side of the walkway facing the river. (This future pier is not subject to Section 4(f).)

The Spaulding Walkway will connect a future path in the Nashua Street Park parcel with a concrete walkway constructed by the MBTA along the railroad tracks leading to the moveable-span railroad trestle or bascule bridge. These elements form links in a future pedestrian walkway system in the Charles River Basin Extension Area. The deck is currently well used in good weather, primarily by patients and visitors at Spaulding Hospital. When the Nashua Street parcel is developed as a park, the MDC-owned walkway will be integrated with its pedestrian circulation and proposed uses as an extension of the Esplanade; accordingly, the Nashua Street Park and the Spaulding Walkway are treated together in this analysis.

Although specific design and programming has not been completed, the Nashua Street Park will function in a manner similar to those other portions of the Charles River Esplanade. Views of the river and pedestrian connections along the river are key attributes. Likely activities at the Nashua Street Park include the extension of the Esplanade path system for walking, jogging, rollerskating, and bicycling; passive activities (sitting on provided benches or grass, sunbathing and picnicking); and informal sports such as games of catch with frisbee, and baseball/softball. The Spaulding Walkway will continue to be used as today and as part of the extended path system.

The MDC master plan proposes a small boat landing along the edge of the parcel. The master plan also proposes a freestanding pedestrian overpass of the MBTA North Station railroad tracks, connecting the Spaulding Walkway to a riverbank downstream. This is an alternative to a future pedestrian overpass required by the MBTA's Chapter 91 license to be constructed as part of a potential air rights garage development of uncertain schedule.

Impacts On Nashua Street Park/Spaulding Walkway By Scheme Z And New Design Alternatives. In Scheme Z, this area is adversely affected by the views of and noise from the six densely nested loop ramps on the north bank of the river, rising to 105 feet in height, directly across the river 430 feet from the downstream end of the park. The double-deck Storrow connector bridge located 360 feet downstream from the Nashua Street parcel (195 feet from the end of the Spaulding walkway), together with mainline bridges of different profile beyond, also have visual impacts and obstruct downstream views from these locations. No shadow impacts extend this far upstream, however. The 1991 Section 4(f) Evaluation concluded that noise and visual impacts adversely affect the Nashua Street park and Spaulding Walkway but do not constitute constructive use of these urban park resources.

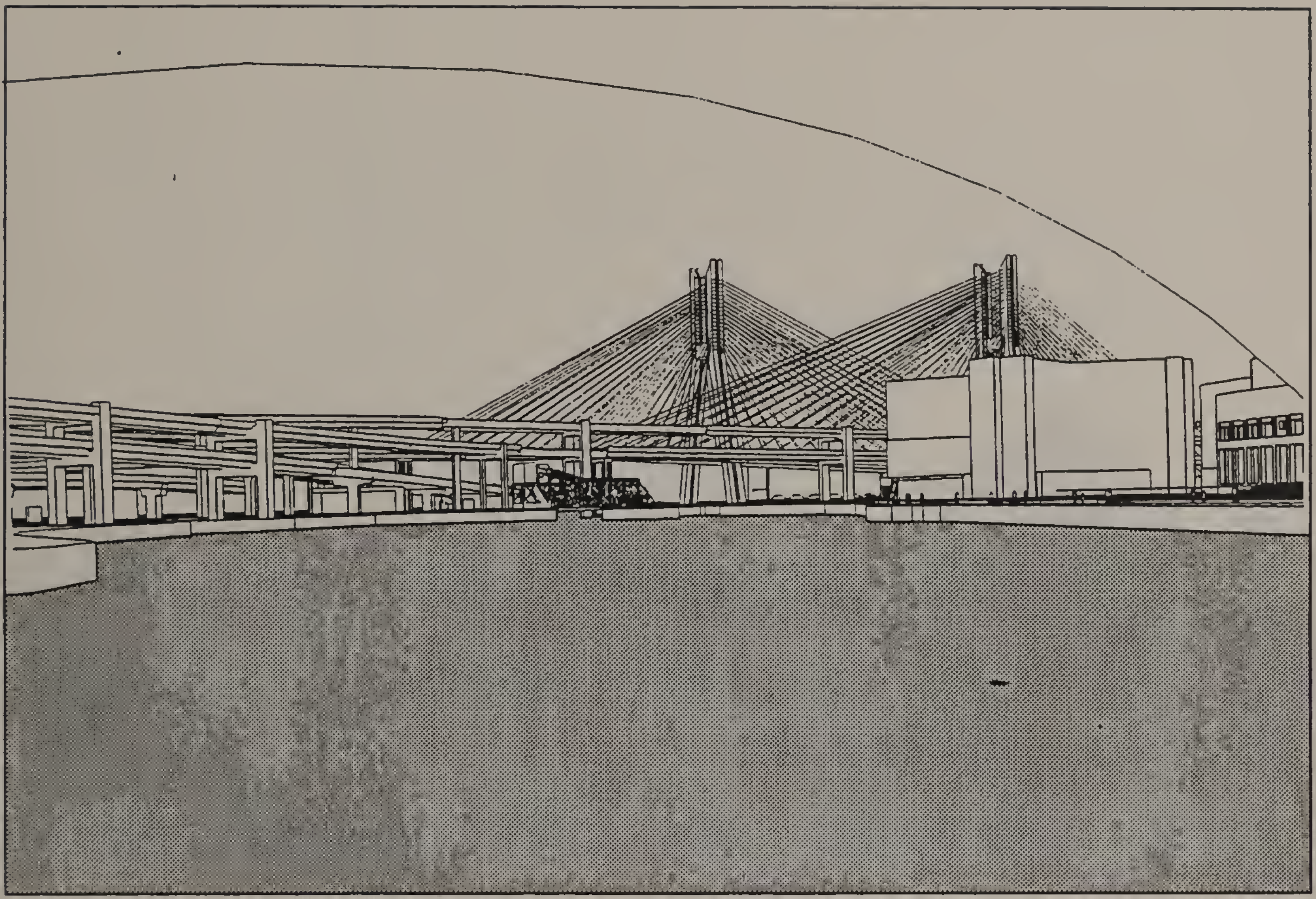
The Preferred Alternative and other new alternatives substantially improve the visual setting by reducing the number and height of loop ramps on the north bank of the river and increasing their setback from the river. Noise at the Spaulding Walkway is marginally reduced by 1 dBA in the Preferred Alternative to 3 dBA in Alternative 8.1D Mod 5.

In Alternative 8.1D Mod 5, there is a single loop ramp 35 to 40 feet high and set back farther from the north bank of the river than in Scheme Z, increasing its distance to 585 feet from the downstream end of the Nashua Street park. A single 10-lane bridge is located 495 feet from the Nashua Street Park, (320 feet from the end of the Spaulding Walkway). An above-ground ventilation building with exhaust-air discharge stacks is located 100 feet from the east edge of the Nashua Street Park but not in it, and may have adverse visual and shadow effects. The three-lane river tunnel and a ventilation duct are located under this parcel, and there is permanent subsurface use of 0.52 acre of the property (see Figure 5). Small tunnel appurtenances such as an emergency egress stair might need to be sited within the park, requiring minimal surface use of the property.

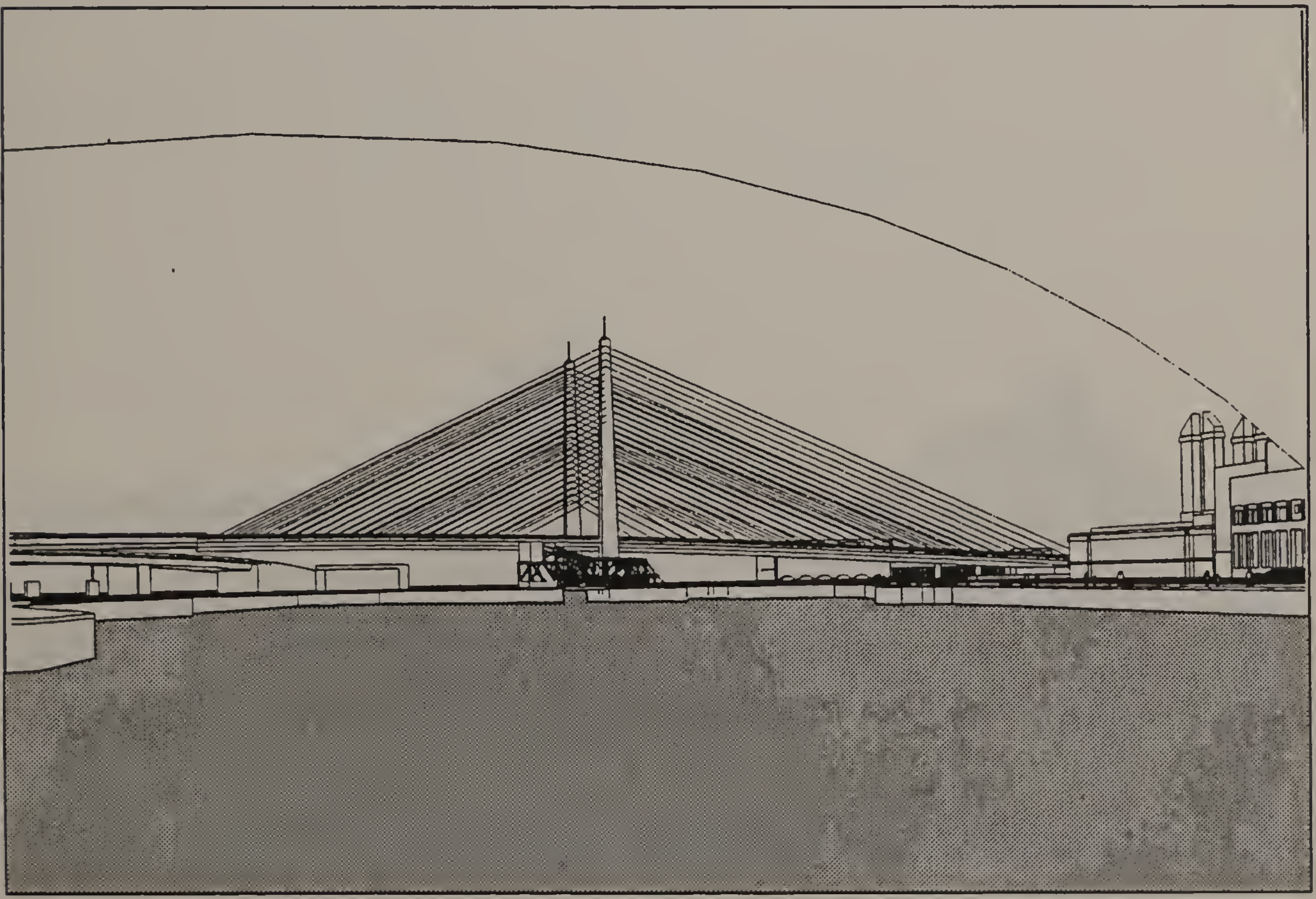
In the Reduced River-Tunnel Alternative, a pair of 35- to 40-foot high loop ramps with similar profiles is set back from the north bank of the river, increasing their distance to 540 feet from the downstream end of the Nashua Street park. The refined version is essentially identical to the Preferred Alternative on the north bank of the river and has a similar appearance to the original version. In both versions, this alternative's single 12-lane bridge is 480 feet from Nashua Street parcel (305 feet from the end of the Spaulding Walkway). A below-ground ventilation structure with exhaust air discharge stacks is located approximately 570 feet south of the park and would have little or no effect on the park. A refinement of this Alternative locates the two-lane river tunnel downstream from the railroad crossing and does not affect the Nashua Street 4(f) property or the Spaulding deck. This refinement does have one larger ventilation building, however.

In the Preferred Alternative, a pair of 35- to 40-foot high loop ramps with similar profiles (after having merged from three ramps well north of the river) is set back from the north bank of the river, increasing their distance to 540 feet from the Nashua Street park. A single-deck Storrow connector bridge is located 360 feet downstream from the Nashua Street parcel (190 feet from the end of the Spaulding walkway). Computer generated perspective studies indicate that this single-deck bridge has substantially less visual impact than Scheme Z's double-deck bridge because of the alternative's lower profile and similar visual impacts to the Reduced River-Tunnel Alternative (see Figures 6 and 7). Overall, this visual setting is substantially improved compared to Scheme Z, whose high, dense loop ramps and double-deck bridge dominate views. In the Preferred Alternative, Nashua Street remains in its existing configuration, and there is no use of land in the 4(f) parcel; this represents a refinement from the Non-River Tunnel Alternative presented in the DSEIS/R, which required the reconfiguration of the eastern end of the parcel. A below-ground ventilation structure with exhaust air discharge stacks is located approximately 600 feet south of the park and has little or no effect on the park. (This ventilation building is now located 220 feet farther from the parcel than described in the DSEIS/R.)

Construction period impacts of considerable magnitude and duration occur in Alternative 8.1D Mod 5. This alternative requires use of the entire parcel during construction of a river tunnel, which would be highly disruptive, for a period of 3 to 4 years, delaying the development of the Nashua Street park for the entire con-



Scheme Z



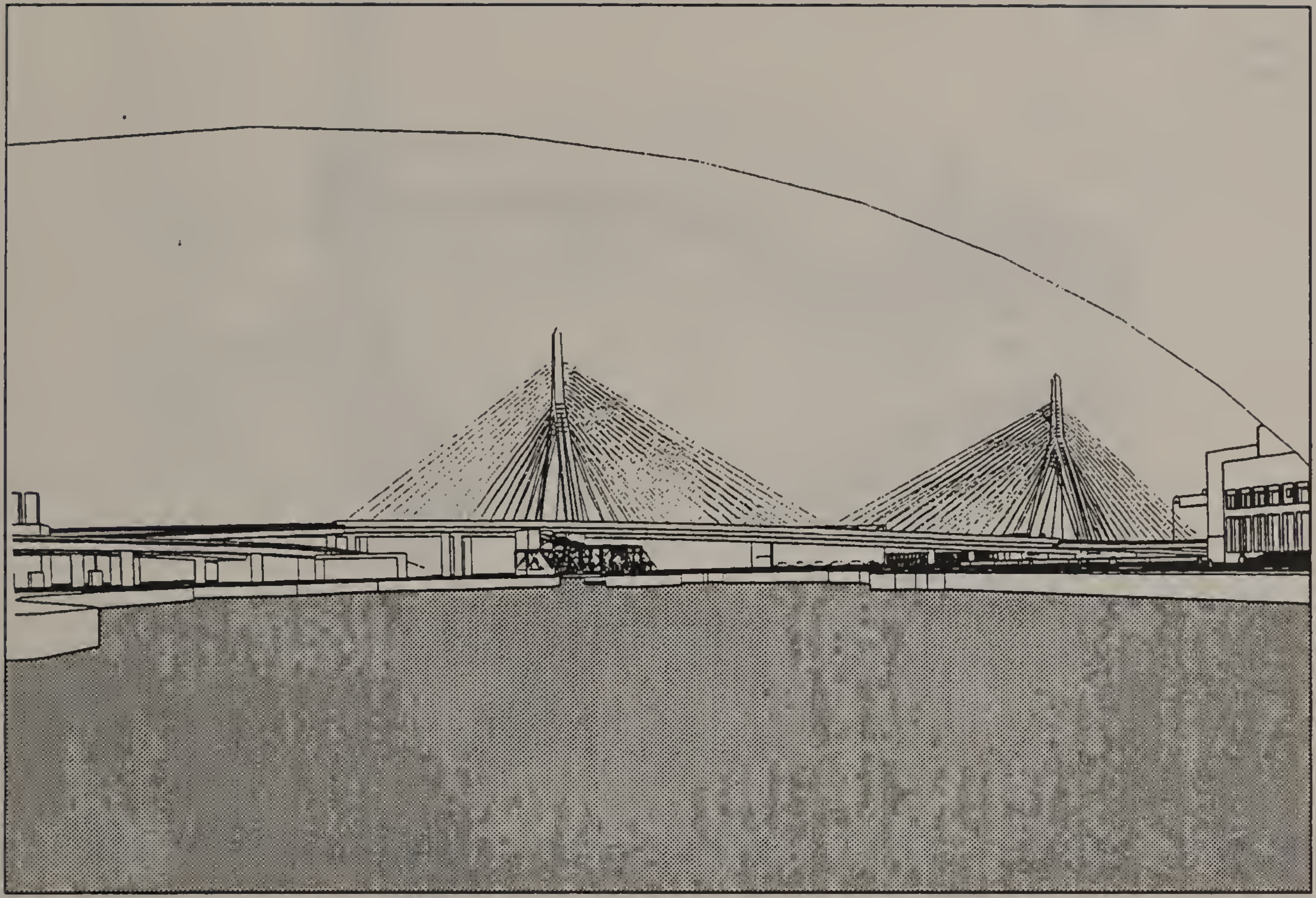
Alternative 8.1D Mod 5

FIGURE 3

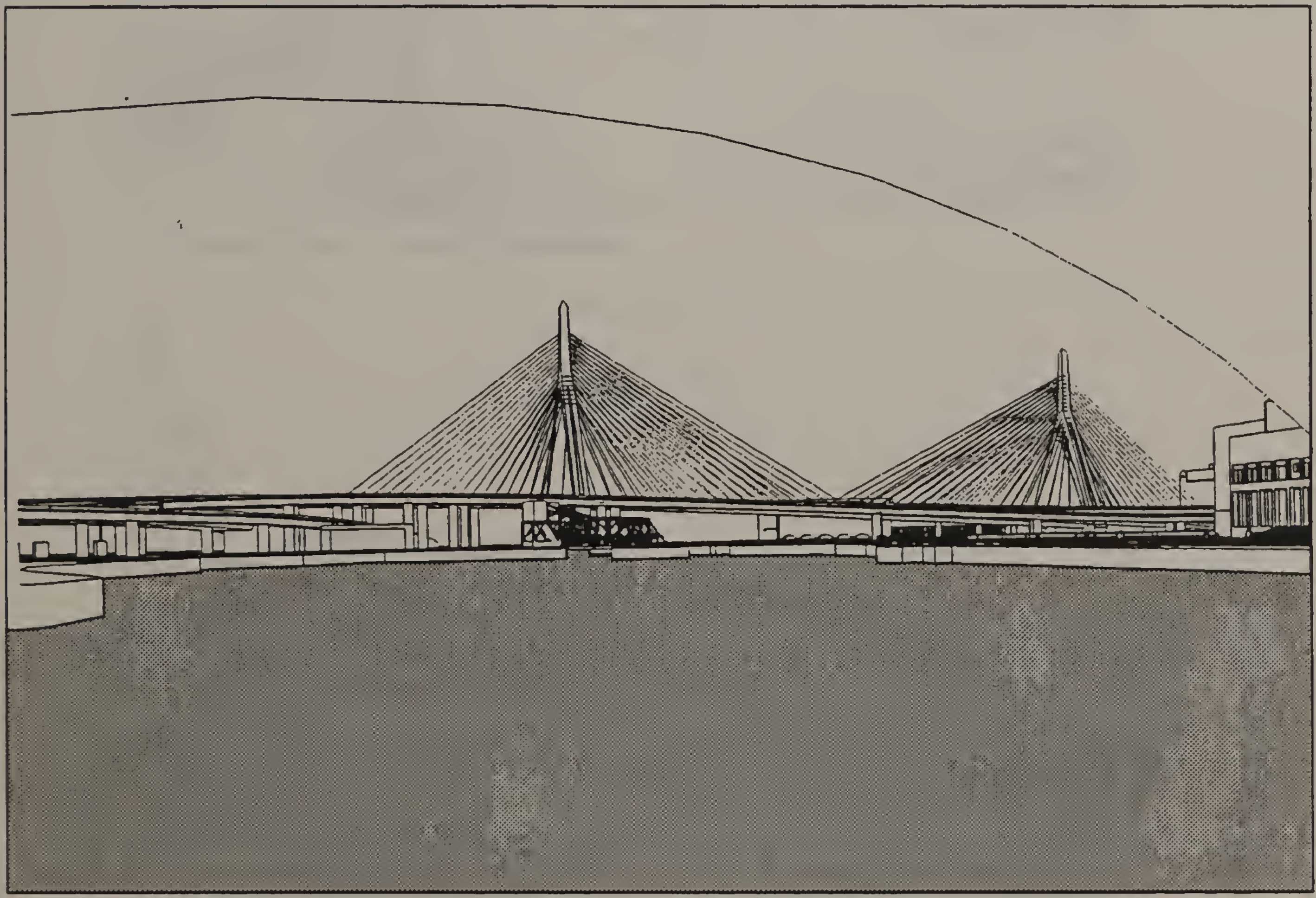
View Of Charles River Basin Extension From Old MDC Dam: Scheme Z And Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT



Reduced River-Tunnel Alternative



Preferred Alternative

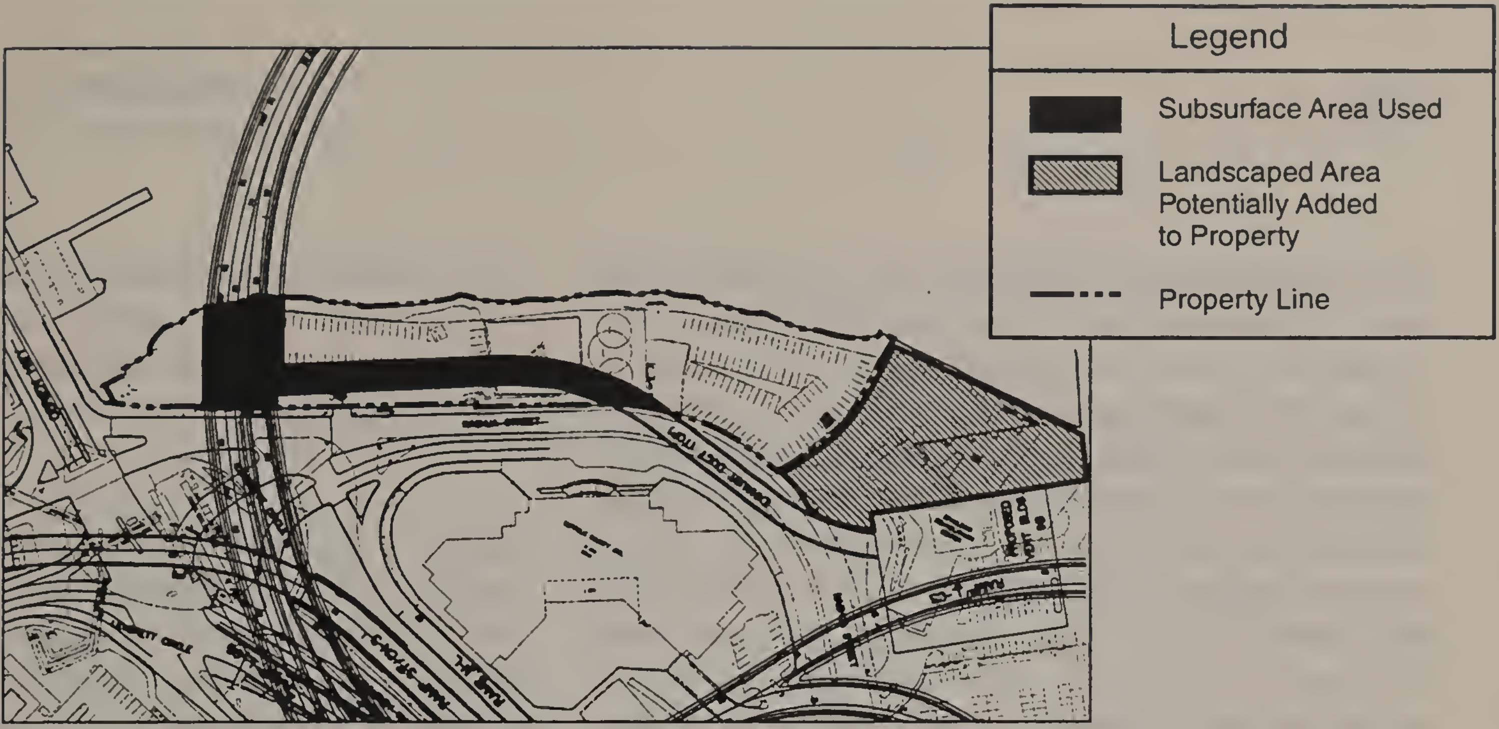
FIGURE

4

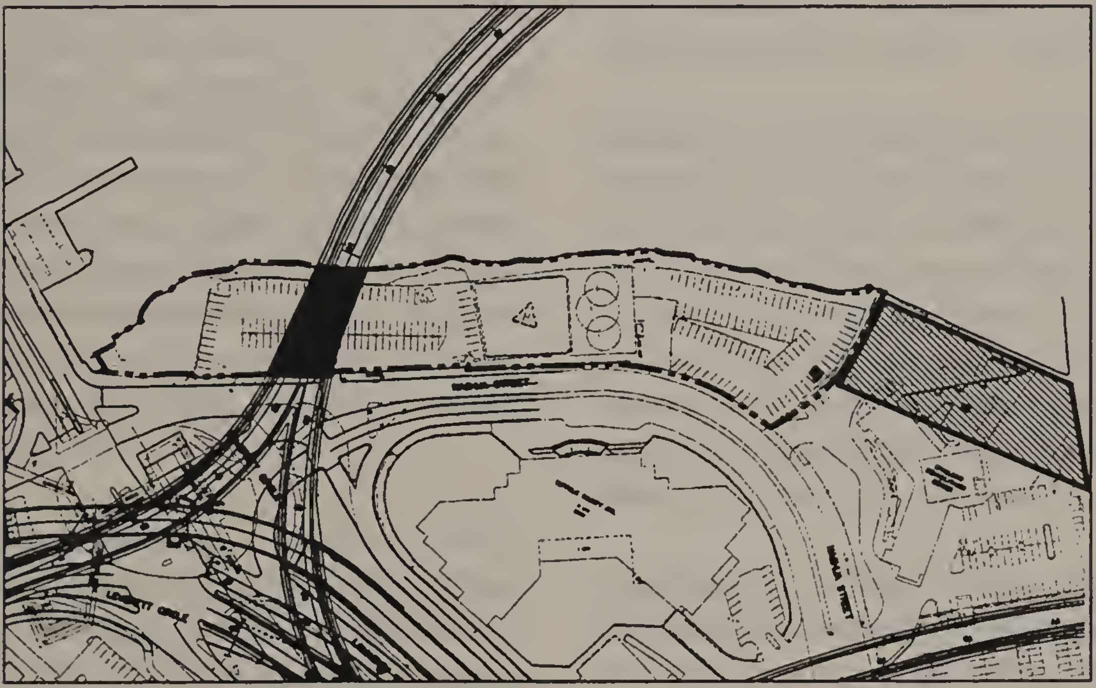
View Of Charles River Basin Extension From Old MDC Dam: Reduced River-Tunnel And Preferred Alternatives

Charles River Crossing FSEIS/R

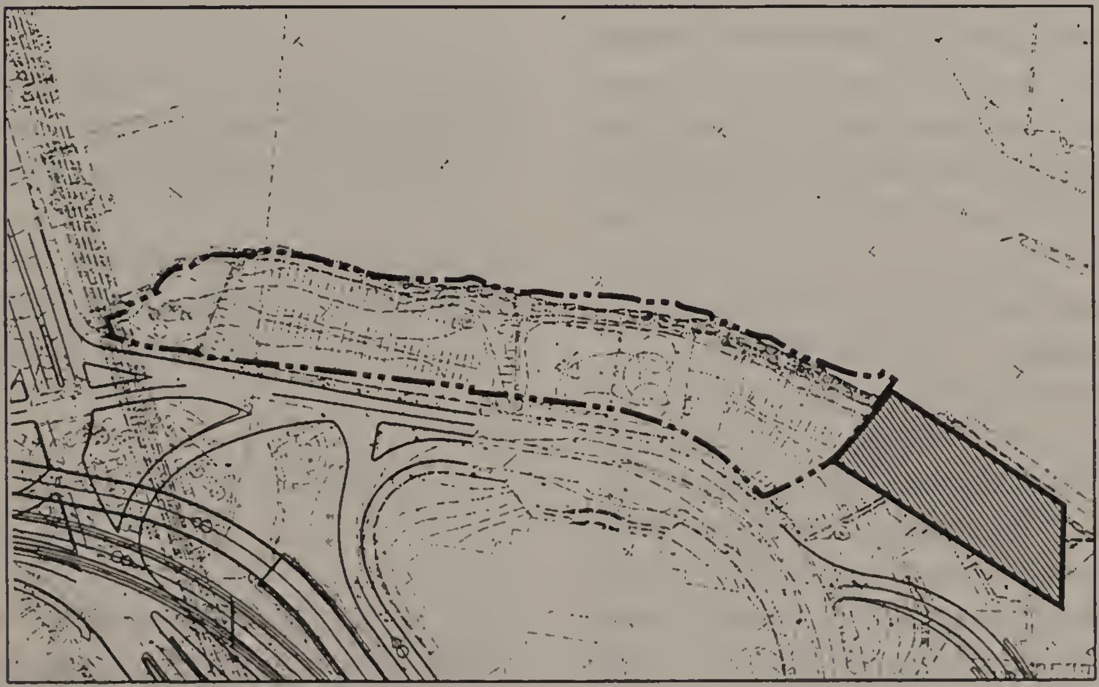
MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


Legend
■ Subsurface Area Used
▨ Landscaped Area Potentially Added to Property
—··— Property Line

Alternative 8.1D Mod 5


NASHUA STREET

Reduced River-Tunnel Alternative



Preferred Alternative

FIGURE

5

Use Of Section 4(f)
Resource: Nashua Street Parcel

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

struction period. (See discussion under Charles River Basin Extension Recreation Area, above.) The Preferred Alternative, the realigned Reduced River Tunnel Alternative, and Scheme Z have no direct construction impact on the parcel.

Summary: By removing most of Scheme Z's visually dominant loop ramps and its double-deck Storrow connector bridge with their attendant noise impacts, the Preferred Alternative substantially improves the quality of the Nashua Street park for its planned uses compared to Scheme Z. Alternative 8.1D Mod 5, whose ramps and highway bridge are further from the parcel requires heavy tunnel construction occupying all of the parcel for 2 to 3 years and delaying any park development for 7 years. The realigned Reduced River-Tunnel Alternative involves no tunnel construction in the parcel and has marginally less visual impact from views of downstream bridges than the Preferred Alternative. In all new alternatives, the improvement in visual setting compared to Scheme Z is substantially the same from a vantage point at the downstream end of the parcel, as demonstrated in Figures 6 and 7.

Avoidance Alternatives. Scheme Z avoids all direct use of the parcel but has long-term visual and noise impacts. The Preferred Alternative and the realigned Reduced River-Tunnel Alternative avoid the parcel and substantially improve its setting to similar degrees by reducing visual impacts.

Due to the alignments of their river tunnels, no way has been found to avoid the parcel in either the Reduced River-Tunnel Alternative or Alternative 8.1D Mod 5.

Conclusion. Based on the above, there is no use or temporary use of the Nashua Street Park and Spaulding Walkway by the Preferred Alternative.

3.5 PARKLAND AT THE FORMER GSA SITE

Description Of The Section 4(f) Property. In 1989, the MDC acquired a parcel of land of approximately 4 acres from the U.S. General Services Administration (GSA) at the northwest bank of the Charles River, opposite the old Charles River dam. The Cambridge/Boston line bisects the property. Half of the parcel currently is occupied by a parking lot and buildings of the MDC central services facility; the remainder is grass covered. There is no current park use of the parcel. Master planning and programming is underway, and the GSA parkland will function in a manner similar to those other portions of waterfront parkland in the Esplanade system. Key attributes are views of the river, the Green Line viaduct and the old MDC dam, and path connections along the north bank of the river between East Cambridge and Charlestown. The GSA parkland will include the extension of the Cambridge side of the Esplanade path system, and active and passive uses. The MDC master plan proposes a docking facility for small boating activities such as canoes and paddleboats.

Impacts On Parkland At The Former GSA Site By Scheme Z And New Design Alternatives. Scheme Z has visual and noise impacts in this area due to its six densely nested loop ramps rising to 105 feet in height at a distance of 300 feet from the GSA parkland and intruding to within 50 feet of the river, thus affecting downstream views. In the new alternatives, the loop ramps are reduced in height and number and their distance from the GSA parkland is increased.

Alternative 8.1D Mod 5 has a single loop ramp 35 to 40 feet high and located 370 feet from the GSA parkland and 180 feet from the Charles River.

The Reduced River-Tunnel Alternative has a pair of loop ramps 35 to 40 feet high with similar profiles and simple supporting structures located 380 feet from the GSA parcel and 135 feet from the Charles River. A ventilation building located near BSG inside the loop ramp 900 feet away has no effect on the GSA parkland.

The Preferred Alternative has three ramps merging to a pair of side-by-side loop ramps with common profiles 35 to 40 feet high, and simple supporting structures located 355 feet from the GSA parcel and 135 feet from the Charles River; a single-deck highway bridge is located 940 feet downstream. Visual impact from the GSA parkland is essentially the same as the Reduced River-Tunnel Alternative and similar to Alternative 8.1D Mod 5. By improving the GSA parcel's visual setting and by providing better pedestrian connections along the north bank of the river, the Preferred Alternative and other new alternatives encourage more use of this park and enhance its role in the overall park system to substantially the same degree.

Construction period impacts occur in Alternative 8.1D Mod 5, whose river tunnel is located 15 feet from the southeast corner of the GSA parkland. Construction of this river tunnel is highly disruptive to the recreational use of the Charles River and may disrupt use of the park on the GSA parcel for a period of 3 years. Major pieces of construction equipment such as cranes and dredges are placed on barges in this portion of the river immediately offshore the GSA park, and a corner of the property extending 30 feet into the park is temporarily used for tunnel construction. On the north bank of the river, there is a casting basin for fabrication of tube sections; the location of these facilities has not yet been determined, but there is a potential for construction noise, dust, and disruption to the GSA parcel due to the graving basin. The original version of the Reduced River-Tunnel Alternative would also have some construction impacts, although its tunnel is farther from the former GSA parcel.

The Preferred Alternative and realigned Reduced River-Tunnel Alternative have no construction impact on the proposed parkland on the former GSA parcel. Scheme Z also has no construction impact on this park.

Summary: All alternatives similarly reduce visual impacts on the proposed parkland on the former GSA parcel; all are a major improvement over Scheme Z. Alternative 8.1D Mod 5 temporarily uses a 30-foot width of land for construction of its river tunnel. The Preferred Alternative, like the realigned Reduced River-Tunnel and Scheme Z, avoids all construction impacts.

Avoidance Alternatives. None of the alternatives permanently uses or constructively uses proposed parkland at the former GSA parcel. The Preferred Alternative, realigned Reduced River-Tunnel Alternative, and Scheme Z also avoid all temporary impacts.

Conclusion. Based on the above, there is no use or temporary use of the former GSA parcel by the Preferred Alternative.

3.6 PAUL REVERE LANDING PARK

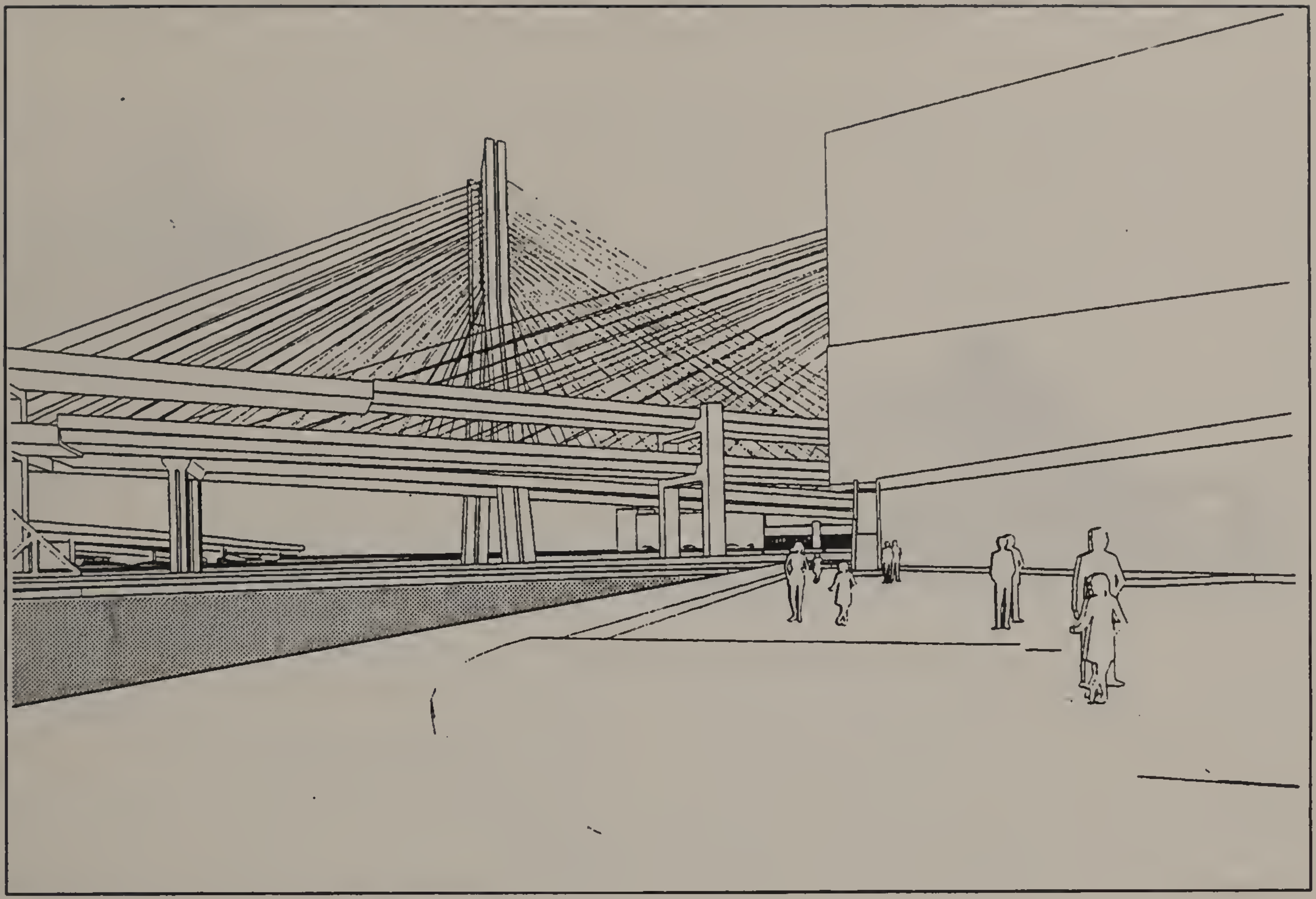
Description Of Section 4(f) Property. The MDC's Paul Revere Landing Park (approximately 6.5 acres) is situated on both banks of the Charles River, linked by a walkway over the Charles River dam locks. The park was developed by the MDC in conjunction with its construction of the new Charles River dam, completed in 1978.

South Bank. The approximately 3-acre south bank portion includes a riverside walkway, benches, four picnic tables, minimal landscaping, and a parking lot with approximately 105 spaces for vanpools and cars of MDC employees at the Harbor Patrol and the Charles River dam and pumping station. Most of the land is devoted to parking. The bottom of the superstructure of the existing Central Artery high-level truss bridge is approximately 50 feet above the mean high water level of the Charles River. The clearance above the park is slightly less, and the bridge visually dominates the park and casts permanent shadows on it. It is isolated from Causeway Street, and access to it is not marked by signs. MHD has easement rights of access in and adjacent to the MDC-owned park for maintenance and other purposes associated with the overhead highway structure. Despite the current constraints, the park is part of a well-used pedestrian crossing of the Charles River via the walkway across the locks of the dam.

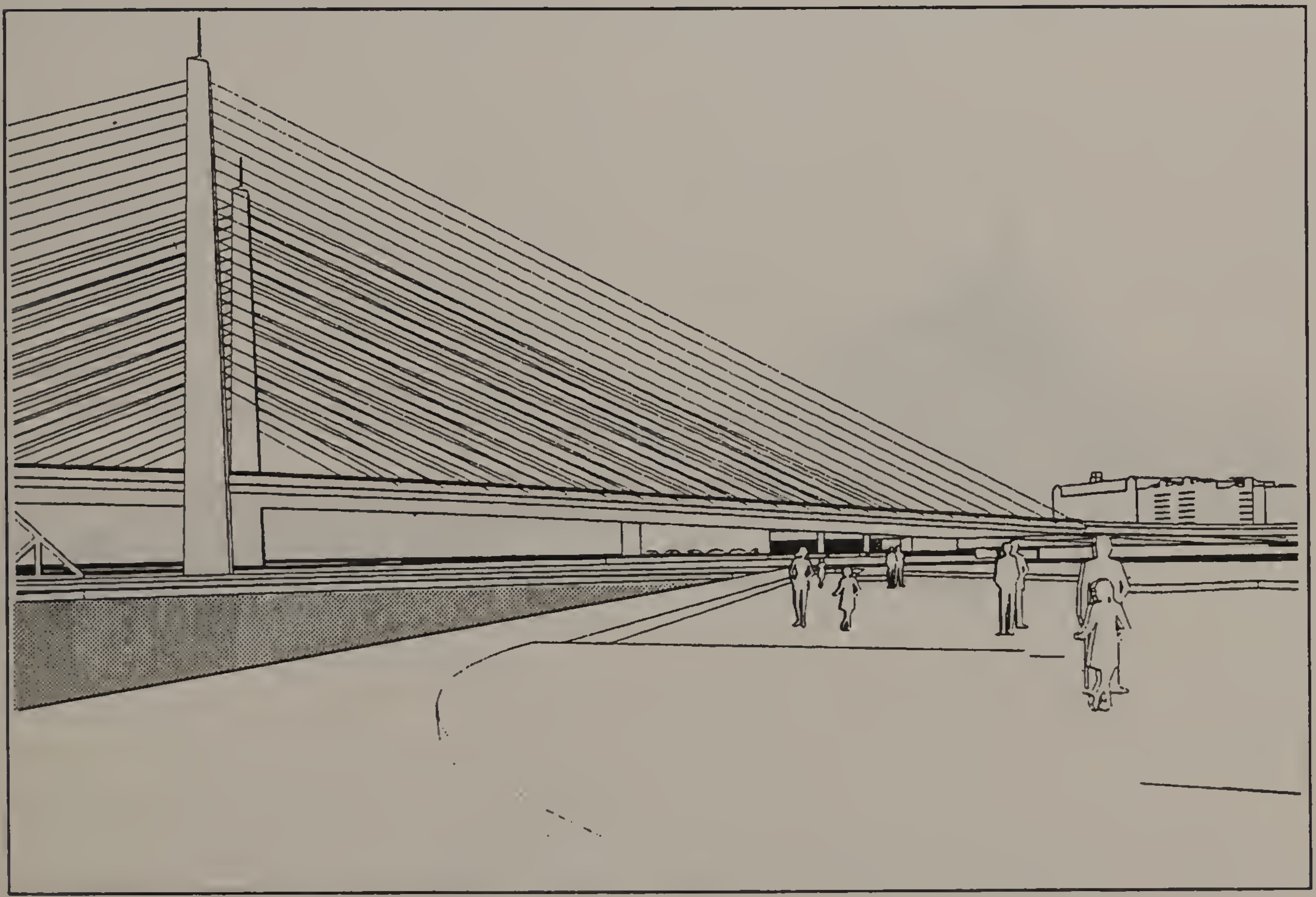
In the future, the south bank portion of Paul Revere Landing Park is planned as an important node in the regional path system (i.e., a place where paths meet), providing an entrance to the riverfront open space system from Causeway Street and the North Station transportation facilities. Connecting paths will lead upstream, across the dam to the north bank, and under the North Washington Street bridge to the MDC North End park and the Boston Harborwalk.

The MDC master plan recommends removal of the current parking lot and addition of landscaping and amenities such as a fountain. Passive uses oriented to the river and the locks of the dam are proposed. The master plan also suggests an active use under the bridge, as consistent with public safety regulations.

Charles River Dam Walkway. Each day, approximately 500 pedestrians cross the Charles River dam between Charlestown and Causeway Street, according to the CANA project construction site manager, on a unique walkway over the lock gates. Additional pedestrian access over the dam is provided through an exhibition gallery along the east side of the dam building. The new Charles River dam was built in 1978 as a flood control facility, functionally replacing the old Charles River dam



Scheme Z



Alternative 8.1D Mod 5

FIGURE

6

View From Downstream End Of Nashua Street Park: Scheme Z And Alternative 8.1D Mod 5

Charles River Crossing FSEIS/R

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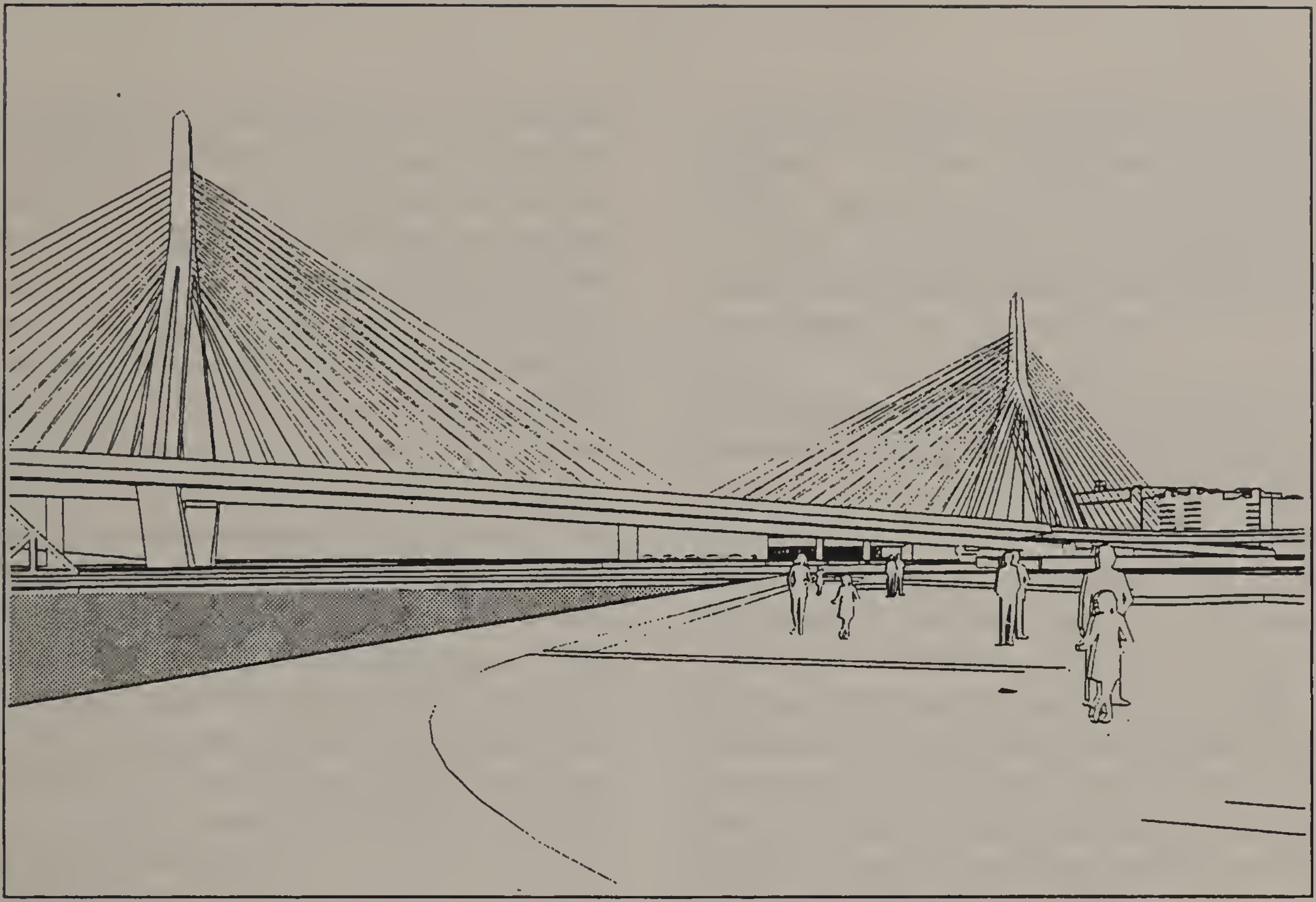
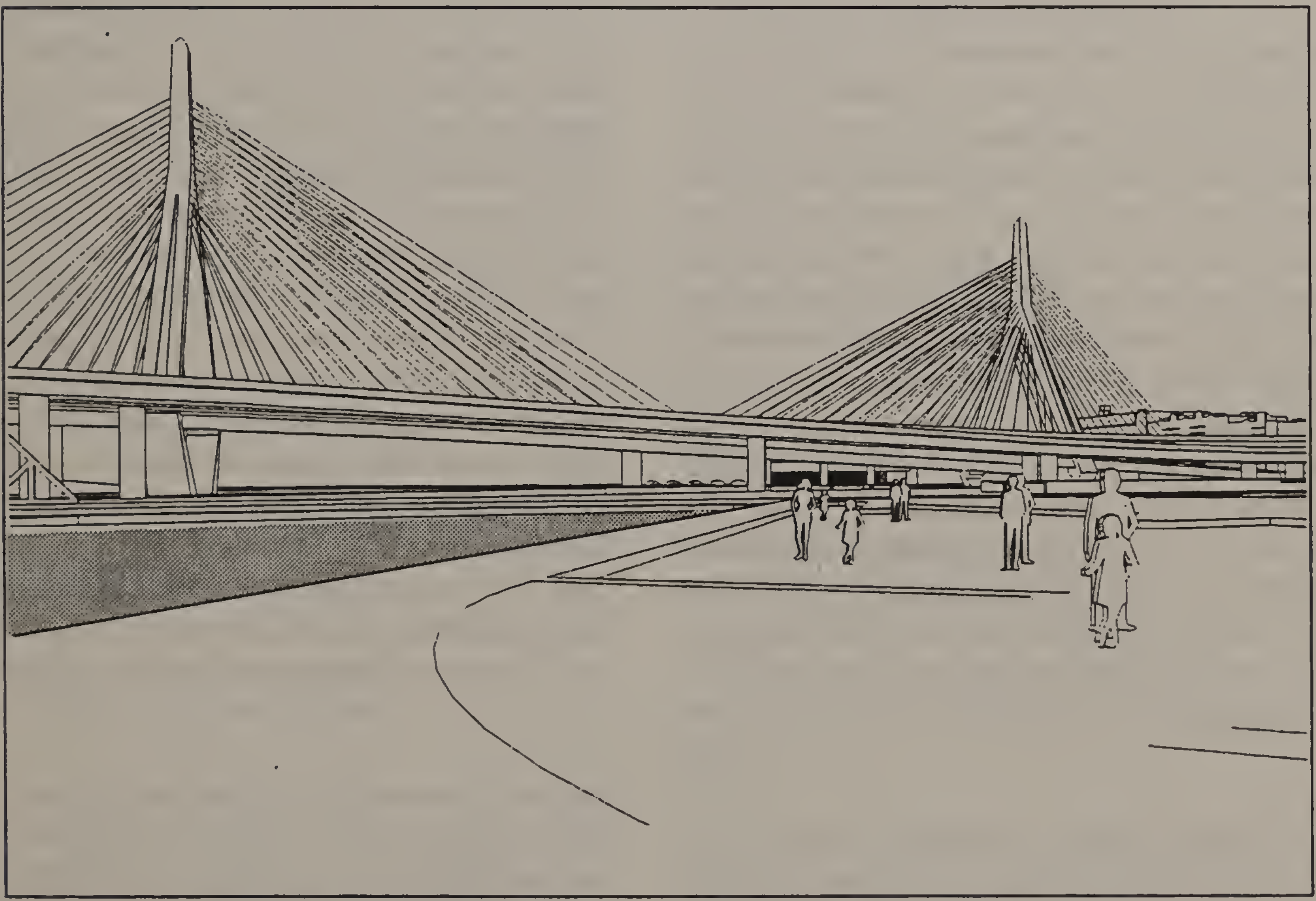


Reduced River-Tunnel Alternative



Preferred Alternative

FIGURE

7

View From Downstream End Of Nashua Street Park: Reduced River-Tunnel And Preferred Alternatives

Charles River Crossing FSEIS/R

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(at O'Brien Highway) farther upstream. It is located between the North Washington Street and Central Artery high-level bridges. The dam includes three locking facilities: two recreational locks, each 200 feet long and 25 feet wide for pleasure craft; and one larger lock, 300 feet long and 40 feet wide, for commercial vessels. In 1992, the annual number of lockings of pleasure craft was approximately 27,000 vessels, reaching a peak flow estimated at 8,000 during the month of July. Annual commercial locking is far less frequent, and is estimated to be 60 vessels (approximately one every 6 days). Commercial vessels include oil, construction, and fireworks barges, the latter making their annual round trip through the lock on the Fourth of July for the celebration farther upstream. A flood control pumping station is located on the north side of the dam, and the MDC Harbor Patrol facility is found on the south side. Within the pumping station is a parkland exhibit space with a 12-minute slide show on the Charles River.

North Bank. The 3.3-acre portion of the park on the north bank of the river was constructed in 1978 along with the Charles River dam. Abutting the park is a 0.3-acre area, a portion of which formerly was part of the park and now is owned by MHD for construction of the CANA project, a separate undertaking. The remaining parkland is landscaped and includes lighting and walkways. The park provides a pedestrian connection between City Square in Charlestown and the walkway across the Charles River dam locks to Causeway Street. Most of the park is being temporarily used for construction of the CANA project. Prior to CANA construction, this portion of the park served for passive recreational uses, primarily walking and sitting with views of the river, and access to the walkway across the dam for jogging, bicycling, and walking. The park is fenced temporarily, and it closes each evening at 6:00 PM. Following CANA construction, this area will in the near future be reconfigured and landscaped for passive use in a manner similar to its previous state.

The CANA project provided for expansion of the park to mitigate construction impacts and to replace parkland taken by that project. This CANA mitigation and replacement land will expand the north bank portion of the park by 1.1 acres to a total of approximately 4.4 acres. As described in the CANA 4(f) Evaluation, park boundaries are extended to the west to include land under the existing I-93 bridge and then-existing ramps. The New Charles River Crossing allows removal of the existing I-93 high-level bridge from this area of future parkland. A portion of the park will be improved by MHD as part of the recent Massachusetts Chapter 91 license for construction of the temporary CANA loop ramps on this filled tideland. All of the three new alternatives expand the park upstream.

The future expanded north bank portion of the park is planned as a major recreation area oriented to the river and dam and serving as both part of the Charles River open space system and as a major neighborhood park for the Charlestown community. This park will be a major node in the path system with connections upstream to the pedestrian overpass at the railroad crossing, two connections downstream under the North Washington Street bridge, to City Square, and to the walkway across the dam to Paul Revere Landing Park. The MDC master plan includes both a large central "meadow" usable for informal sports, and a playground area along the park's north edge.

Impacts On Paul Revere Landing Park By Scheme Z And New Design Alternatives.

South Bank: All designs have a combination of benefits and impacts to Paul Revere Landing Park South: while removing the overhead viaducts that currently blight this park, the new mainline bridge occupies a portion of its 3 acres of land. Rising from a tunnel under Causeway Street in a boat section that ends near the southern end of the park, the northbound mainline in all alternatives is supported on retained fill to a point where the bridge structure begins 25 to 45 feet back from the top of the riverbank, depending on final bridge design and mitigation in this area. The presence of heavy traffic separated from ground-level park users by a vertical wall requires mitigation in all designs. Because of the relatively low bridge profile, most of Paul Revere Landing Park South is free of shadows from 9:00 AM to 3:00 PM, except for the portion under the bridge decks. Noise is similar to Scheme Z in all alternatives (within 2 dBA).

The Preferred Alternative occupies approximately 0.85 acres of Paul Revere Landing Park South with its highway supported on retained fill as it rises from below grade to the mainline bridge that crosses the Charles River. Total aerial use in the south bank portion of the park is 0.41 acre, including the riverbank to the water line (these figures are based on worst-case assumptions about the location of the abutment wall, which is dependent on the further development of the bridge design.). The park area downstream of the bridge is roughly triangular, with a maximum dimension of approximately 170 feet at the corner of the dam, and this triangular area fulfills the planned functions of the park as a path connection and passive use area focused on the river and the dam (see Figure 8). Active use under the bridge is constrained by the relatively low bridge height ranging from 9 feet to 18 feet above the path along the riverbank. The approach to the park is 38 feet wide at the Charles River Building and 25 feet wide from the retaining wall to the top of riverbank as one enters the park near Lovejoy Wharf.

Scheme Z occupies approximately 0.61 acres of Paul Revere Landing Park South with its highway supported on retained fill as it rises from below grade to the mainline bridge that crosses the Charles River. Total aerial use in the south bank portion of the park is 0.35 acres, including the riverbank to the water line. The park area downstream of the bridge is roughly triangular, with a maximum dimension of approximately 195 feet at the corner of the dam, and this triangular area fulfills the planned functions of the park as a path connection and passive use area focused on the river and the dam (see Figure 8). Active use under the bridge is constrained by the relatively low bridge height ranging from 10.5 feet to 20 feet above the path along the riverbank. The approach to the park is 75 feet wide at the Charles River Building and 56 feet wide from the retaining wall to the top of riverbank as one enters the park near Lovejoy Wharf.

The Preferred Alternative and other new alternatives narrow the approach to the park property from Causeway Street, but there is little difference among the new alternatives and Scheme Z in the manner in which Paul Revere Landing Park South can be improved to serve as a major entry area to the park system as envisioned in the MDC master plan. All new alternatives significantly improve bridge aesthetics as viewed from the park. In all alternatives, the planned functions and uses reflected in the MDC master plan can be implemented successfully.

North of Lovejoy Wharf, Alternative 8.1D Mod 5 is approximately 20 feet narrower than Scheme Z as it enters Paul Revere Landing Park South because of the relocation of one lane of northbound Central Artery traffic to the river tunnel. The portion of the park not used by the highway is roughly triangular, gaining width as the riverbank rapidly diverges from the highway; the park property reaches a maximum width of 225 feet near the dam. Total use of the south bank portion of the park south of the abutment wall is 0.44 acre. Total aerial use between the abutment wall and the river is 0.32 acre, including the riverbank to the water line (these figures are based on worst-case assumptions about the location of the abutment wall, which is dependent on the development of the bridge design). The same type of park design and program as in the Preferred Alternative could be accommodated, with a marginal benefit in Alternative 8.1D Mod 5 due to its slightly greater park area. As in the Preferred Alternative, bridge design and the absence of supporting piers near the south riverbank make Alternative 8.1D Mod 5 aesthetically superior to Scheme Z, adding to the attractiveness of the park. As in The Preferred Alternative, active use under the bridge would be constrained by the relatively low bridge height, ranging from 10.5 feet to 18 feet on the path along the Charles River.

Alternative 8.1D Mod 5's boat section includes an additional ramp element and flares to a greater width south of Lovejoy Wharf than that of Scheme Z, narrowing the pedestrian approach to the park to 63 feet wide at the Charles River building (this access way is not currently part of the MDC property). The width of the pedestrian approach from Causeway Street increases as the visitor passes Lovejoy Wharf, and views open to the river on the right. The riverbank cuts in toward the highway just north of Lovejoy Wharf; in the area between the Wharf and the current MDC property Alternative 8.1D Mod 5 is narrower than Scheme Z, and the minimum width of this area, which would be added to the park, is 76 feet.

The Reduced River-Tunnel Alternative is identical to the Preferred Alternative at Paul Revere Landing Park South. Both are 30 to 38 feet wider in the park than Scheme Z owing to their two-tower bridge design and to restoration of a northbound Central Artery on-ramp whose absence in Scheme Z resulted in significant traffic failures. In both alternatives, the portion of the park not used by the highway is roughly triangular, gaining width as the riverbank rapidly diverges from the highway; the park property reaches a maximum width of 170 feet near the dam, which is adequate to create the type of plaza envisioned in the MDC master plan. Bridge design and the location of fewer supporting piers near the ri-

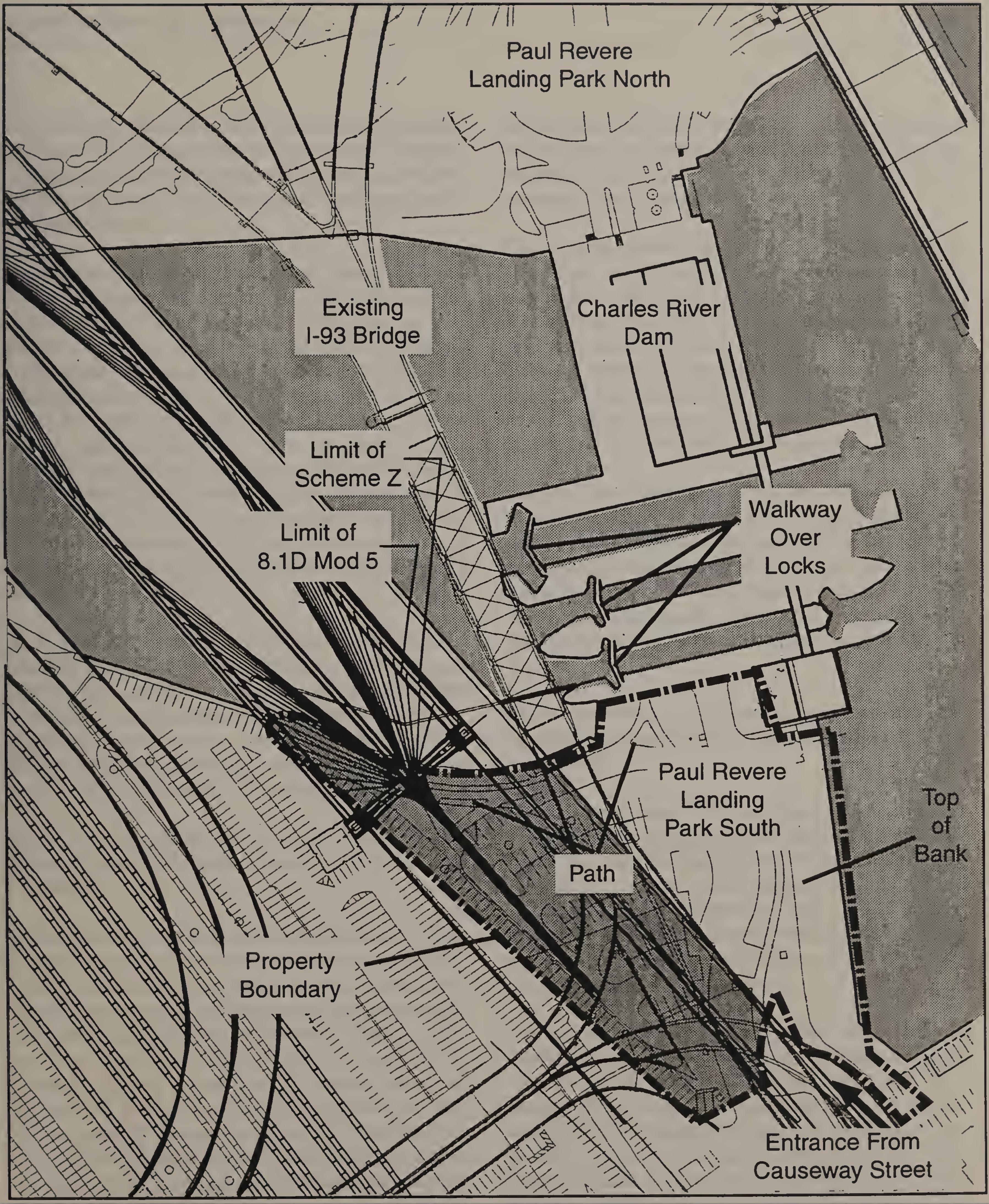
Paul Revere Landing Park North
Existing I-93 Bridge
Charles River Dam
Limit of Scheme Z
Limit of 8.1D Mod 5
Walkway Over Locks
Paul Revere Landing Park South
Path
Top of Bank
Property Boundary
Entrance From Causeway Street

FIGURE 8

Use Of Section 4(f) Resource by Preferred Alternative: Paul Revere Landing Park South

Charles River Crossing FSEIS/R

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verbank make these alternatives aesthetically superior to Scheme Z, adding to the attractiveness of the park. Bridge shadows are broken by sunlight passing between the main bridge deck and the cantilevered lanes on the downstream side.

In both the Preferred Alternative and Reduced River-Tunnel Alternative, the approach to the park property from Causeway Street is adequate for pedestrians and bicycles, two-way passage of official vehicles, and some landscaping. Because of a wider boat section in these alternatives, the access way is narrower than in Scheme Z, 38 feet wide at the Charles River Building. As the visitor approaching from Causeway Street passes Lovejoy Wharf, views open to the river on the right. The riverbank cuts in toward the highway just north of Lovejoy Wharf; this area between the wharf and the current MDC property, which is added to the park, is 25 feet wide at its narrowest point, functionally adequate for entry to the park.

In all new alternatives, as in Scheme Z, Paul Revere Landing Park South is occupied for several years by construction activities during erection of the Charles River crossing and demolition of the existing I-93 bridge. Pedestrian access to the walkway over the locks and official vehicular access to the dam are maintained except for brief interruptions for safety reasons.

Summary. Successful use and improvement of Paul Revere Landing Park South is equally possible in all alternatives.

In all alternatives, within the southbank portion of the park there is adequate area to provide a successful landscaped plaza serving as a major entry to the park system. There are also major impacts in all alternatives due to the use of parkland, and the presence of heavy traffic separated from ground-level park uses by a vertical wall; although different in type from the current impacts of the existing overhead structure, these future impacts require carefully designed mitigation. While all three new alternatives have bridges which reduce overhead clearance on the southbank riverfront path compared to Scheme Z, the bridges in these new alternatives are far superior aesthetically and thus contribute to the success of this park for which the bridge is the major backdrop. (In the new bridges, an architectural abutment wall is located based on a design criterion for headroom, e.g., 8 feet of overhead clearance. This wall could be moved farther from the river if the bridge deck is thinner than in the worst case design assumption, making the area under the bridge both higher and larger; lowering the existing ground would have the same benefit.)

The new alternatives differ in the width of the approach from Causeway Street (on property not currently part of the park); the Preferred Alternative and Reduced River-Tunnel Alternative leave a narrower access way than Alternative 8.1D Mod 5. This access is nonetheless wide enough for unconstrained passage by pedestrians and bicycles, for two-way access for official vehicles, and for landscape treatment appropriate to the buildings of the bordering historic district.

The MDC has concurred that Paul Revere Landing Park, although impacted on south bank by the Preferred Alternative, can be successfully developed at this location as a landscaped plaza for recreational use and to provide a suitable entry to the New Charles River Basin. The MHD and MDC have also agreed to a series of specific park improvement measures to minimize harm to this park parcel.

These improvements are proposed for the Preferred Alternative, as described below under Measures to Minimize Harm.

Charles River Dam Walkway: The 1991 Section 4(f) Evaluation concluded that under Scheme Z, future air, noise, and vibration impacts on the dam are less than those existing, since its new bridges are farther away (140 to 375 feet as compared to the 55 to 120 feet for the existing bridge); the walkway is virtually free of bridge shadows, even in winter; and Scheme Z has no impact on the walkway except visually.

In the long term the Preferred Alternative and other new alternatives also have no impact on the walkway except visually. In this respect, all are superior to Scheme Z because of their superior bridge aesthetics. All new alternatives have bridges with the same aesthetically improved profile 25 to 50 feet above the river surface, and all have bridges in a similar location with respect to the walkway. In Alternative 8.1D Mod 5, the bridge is 160 feet upstream from the walkway at its closest point. In both the Reduced River-Tunnel and Preferred Alternative, the bridge is 110 feet away at this point. These differences in distance do not substantially change the experience of walking across the locks in any of the new alternatives.

Construction impacts in all new alternatives are the same as for Scheme Z: that is, pedestrian access across the dam lock gates is temporarily interrupted on an intermittent basis for about 1 year, for safety reasons, while the existing I-93 bridge, which is overhead, is dismantled and removed following construction of the new I-93 bridge.

North Bank: The Preferred Alternative relocates the Charles River Crossing 285 feet upstream significantly farther from the parkland than the existing I-93 bridge, permitting the expansion of this part of Paul Revere Landing Park farther to the west than called for in the CANA Project Section 4(f) Evaluation (which adds 1.1 acres to the park, including 0.4 acre directly under the existing I-93 bridge). It expands the park to the north by 150 to 200 feet by eliminating the tunnel/boat connection of Alternative 8.1D Mod 5 and the Reduced River-Tunnel Alternative. The closest ramp on the north side of the park is a depressed boat section, and the total expansion of the park is 4.3 acres, which was cited by the MDC as a benefit in its comment letter of October 5, 1993, on the DSEIS/R. The Preferred Alternative also improves the visual setting of Paul Revere Landing Park North.

Scheme Z relocates the Charles River crossing 355 feet from the Park. The expansion of this portion of the park is 2.5 acres, including the 1.1 acres required for the CANA project. In Scheme Z, there are residual visual impacts on this part of the park due to the three bridges crossing the river upstream, although these visual impacts are of less severity than views of the existing I-93 viaduct connections to the Tobin Bridge which currently border the park on two sides. There are also noise impacts in Scheme Z from the traffic on the viaducts and from the City Square intersection.

The new alternatives expand the park westward to approximately the same extent as Scheme Z, but they also widen the park to the north (away from the river) by realigning the Central Artery-to-Tobin Bridge loop ramp and by relocating the Central Artery local off-ramp from City Square. This results in an increase in parkland at a location where it can be best used by the Charlestown community and regional park users. Noise at Paul Revere Landing Park North is essentially the same as Scheme Z (within 1 dBA). Air quality at nearby City Square is improved in all new alternatives. One-hour carbon monoxide (CO) concentrations in the year 2010 are reduced from 12.1 ppm in Scheme Z to 9.1 ppm in Alternative 8.1D Mod 5, and 8.7 ppm in the Reduced River-Tunnel and Preferred Alternative (see Section 4.3, Air Quality, of this FSEIS/R).

In Alternative 8.1D Mod 5, the off-ramp to City Square is removed, allowing the park to expand 150 to 175 feet to the north as well as 350 feet upstream along the river; the total area of expansion is 4.1 acres. Views are improved by the new bridge design, and the closest highway ramp along the north edge of the park is a depressed boat section rather than a surface ramp, reducing noise and visual impact next to the area proposed in the MDC master plan as a playground.

The Reduced River-Tunnel Alternative is similar to Alternative 8.1D Mod 5, expanding the park both upstream by 285 feet, and to the north by 150 feet, and improving views. The closest ramp on the north side of the park is a depressed boat section, and the total expansion of the park is 3.6 acres. The refined version of the Reduced River-Tunnel Alternative is identical to the Preferred Alternative next to Paul Revere Landing Park.

Summary: The Preferred Alternative extends the north portion of the Paul Revere Landing Park to a greater extent than in Scheme Z and other new alternatives, providing additional area for both informal sports activities in the central "meadow" and the potential playground envisioned in the MDC master plan. Visual impacts near the proposed playground are also improved. In all alternatives, the park has adequate size to serve as a major node in the park system on both banks of the river. The Preferred Alternative and other new alternatives similarly improve north bank pedestrian connections between Paul Revere Landing Park, and they improve the visual setting of the entire park to substantially the same degree.

Avoidance Alternatives. As discussed in detail in the 1991 Section 4(f) Evaluation, incorporated by reference, it is not possible to avoid the Paul Revere Landing Park South property because of the highly constrained corridor available for the I-93 Charles River crossing. All-tunnel crossings of the Charles River have been extensively examined and no acceptable solutions have been discovered, because of geometric and constructibility problems and the many natural and man-made constraints near Paul Revere Landing Park. A design refinement to the Reduced-River-Tunnel and Non-River-Tunnel Alternatives described in Sections 2.6.2 and 2.6.3 of the DSEIS/R proposed substituting a five-lane northbound I-93 for the current four lanes plus two outside lanes reducing, but not avoiding, use of land in the park. This refinement had a number of problems which could not be resolved, including an unacceptable traffic weave on the I-93 mainline bridge; a much wider viaduct which encroached on five tracks in the MBTA railroad yard north of the Gilmore Bridge, seriously conflicting with the commuter rail service; and a loop ramp alignment which conflicted structurally with the MWRA pumping station and its underground storage tank. Other attempts since the DSEIS/R to reduce bridge cross-section by changing the configuration of travel lanes have also been unsuccessful.

Conclusion. Based on the above, there is no feasible and prudent alternative to the use of land from Paul Revere Landing Park. The Preferred Alternative includes all possible planning to minimize harm to this property resulting from such use, as described in Section 3.8, below.

3.7 OVERALL COMPARISON OF IMPACTS ON MDC 4(f) PARKLANDS

The following section compares the impacts on MDC Section 4(f) parklands within the Area North of Causeway Street from the perspective of how each alternative affects this interrelated group of parklands as a system.

The Preferred Alternative and the other new alternatives all have the same goal with respect to parkland in this area of the Charles River: to facilitate the achievement of the MDC's long-range park objectives by reducing the major adverse proximity impacts of Scheme Z. The MDC's objectives, restated in its December 30th, 1993 letter, are to create continuous pedestrian paths along the banks of the river, to develop areas of sufficient size to support recreation, and to provide a setting in which views of the river contribute to these paths and recreation areas. These MDC objectives are facilitated through designs which reduce the number and size of loop ramps on the north bank of the Charles River and which improve the aesthetics of the Charles River crossing, while minimizing other impacts to Section 4(f) resources.

Table 1 compares and summarizes the impacts of the alternatives at two levels of detail. Table 1 and the paragraphs which follow consider these impacts for the overall park of which these parcels are part, as well as for the parcels individually.

Nashua Street Parcel, GSA Parcel, and Charles River Basin Extension Recreation Area. All three new alternatives make a great improvement over Scheme Z at the three parks located upstream of the railroad crossing. Visual impacts are reduced in all three alternatives, and noise is improved in some locations. Differences between the Preferred Alternative and other new alternatives are minimal as viewed from these parks (see Figures 3, 4, 6, and 7; in these views, the realigned Reduced River-Tunnel Alternative is identical to the original version). Loop ramp configurations appear much the same from most vantage points in these parks. Alternative 8.1D Mod 5 has an above-ground ventilation building close to the Nashua Street park, while the Reduced River-Tunnel and Preferred Alternatives have smaller, below-ground ventilation buildings farther from the park. The separate Storrow Drive connector bridge in the Preferred Alternative has a profile that is similar to the mainline bridge beyond so that the two bridges are much more visually harmonious than the bridges of Scheme Z, a substantial visual improvement. Although its second bridge will be perceptible as closer to these parks than the bridges of the other two new alternatives, the Preferred Alternative is much more similar to 8.1D Mod 5 and the Reduced River Tunnel Alternative than it is to Scheme Z, which has a much higher double-deck bridge.

Alternative 8.1D Mod 5 has a river tunnel which causes substantial construction disruption to the use of the river and the GSA parcel and delays improvement of the Nashua Street park for an extended period. Since the DSEIS/R, a refinement which relocates the Reduced River Tunnel Alternative's tunnel alignment downstream of the railroad crossing has been examined; the refinement makes it equivalent to the Preferred Alternative in avoiding construction impacts to these three upstream parks.

The effect of the three new alternatives on park values and functions is essentially the same at the Nashua Street park/Spaulding Walkway, Charles River Basin Extension Recreation Area, and park on the former GSA parcel. As a result, these parklands are better able to fulfill a crucial role in creating an integrated park system in the Area North of Causeway Street, extending the Esplanade toward Paul Revere Landing Park. The Preferred Alternative completely avoids the Nashua Street park.

In summary, the Preferred Alternative and the other two alternatives to Scheme Z improve, to substantially the same degree, the visual setting which contributes value to these upstream parks. Alternative 8.1D Mod 5 has some marginal advantages in the size and location of its highway structures, but it also has major construction impacts that delay improvements and affect use.

Leverett Circle/Storrow Drive. Leverett Circle is reconfigured in Scheme Z and in all three new alternatives. While these alternatives differ in the design of the intersection and in the details of changes to Storrow Drive, the Charles River Esplanade is not directly affected by any alternative. Mitigation is required since there is use of the MDC parkway and its roadside landscaping. The refinements to the Reduced River Tunnel Alternative reduce the depth and length of its eastbound boat section at Leverett Circle, making the refined version essentially the same as the Preferred Alternative. In Alternative 8.1D Mod 5, although the appearance of Storrow Drive has changed less, substantially worse congestion occurs next to the Esplanade. Efforts to resolve the deficiency through design refinements to Alternative 8.1D Mod 5 and to satisfy FHWA concerns regarding safety in this area proved unsuccessful.

Paul Revere Landing Park. All the new alternatives expand the north portion of Paul Revere Landing Park substantially more than Scheme Z, more than doubling its size. The expansion of this portion of the park is greatest under the Preferred Alternative, with an equal expansion in the refined Reduced River-Tunnel Alternative. The Preferred Alternative and other new alternatives also improve the setting of this portion of the park by removing a surface highway off-ramp to City Square and by substituting a greatly improved bridge design that is both aesthetically superior and provides better sight lines than in Scheme Z. The width and quality of the planned pedestrian connection between Paul Revere Landing Park North and the GSA parcel are dramatically improved in all new alternatives.

In the south bank portion of the park, all alternatives, including Scheme Z and the Preferred Alternative, require use of a portion of the MDC property. All alternatives introduce interstate highway traffic near ground level, requiring mitigation. However, all alternatives leave an adequate area for a landscaped plaza serving as a recreation area and a major entry to the overall park system. The adequacy of this area in the Preferred Alternative and other new alternatives, together with the removal of the existing overhead structure, provides an opportunity for successful mitigation. When land used in the south portion is subtracted from the expansion of the north portion, the Preferred Alternative and refined Reduced River-Tunnel Alternatives are identical, and provide approximately the same net increase as 8.1D Mod 5, with a slightly smaller net increase for the original version of the Reduced River-Tunnel Alternative.

The alternatives to Scheme Z have improved bridge designs with fewer piers and superior aesthetics, improving the park setting. A trade-off in this improved bridge design is a deeper bridge deck which reduces vertical clearances at the riverfront path. While access along the south bank of the river is not impeded, the area under the bridge requires specific mitigation in all alternatives. The alternatives differ to some extent in the width of the access way from Causeway Street to the MDC property. This access corridor is widest in Alternative 8.1D Mod 5 and narrowest in the Reduced River-Tunnel and Preferred Alternatives, which are identical in Paul Revere Landing Park South. In the Preferred Alternative, the access is sufficiently wide to provide unconstrained pedestrian and bicycle access to the park system and to accommodate official vehicles.

In summary, when both portions of Paul Revere Landing Park are considered and compared to Scheme Z, the Preferred Alternative provides a substantial increase in total parkland area, an adequate size for the planned use in the south portion, an improved visual setting, and an improved north bank connection to upstream parkland. In these respects, the Preferred Alternative is substantially similar to the other alternatives to Scheme Z.

Overall Summary And Conclusion. This Section 4(f) Evaluation presents a Preferred Alternative and two other alternatives, whose differences are less significant than their similarities when compared to Scheme Z. All are a major improvement over Scheme Z in their proximity impacts on current MDC park property and the extent to which an integrated parkland system in this area can be successfully implemented, as contemplated in the MDC master plan. The MDC has concurred in its December 30, 1993 letter that the Preferred Alternative is a substantial improvement over Scheme Z because it reduces proximity and visual impacts on the Charles River parkland and pedestrian access area. The MDC has also concurred that the Preferred Alternative is consistent with and positively facilitates achievement of the key park objectives of the MDC master plan for the New Charles River Basin. All new alternatives provide usable continuous pedestrian access along the river. They all provide major park parcels of sufficient size to support recreation, as envisioned in the MDC master plan. They all expand Paul Revere Landing Park more than Scheme Z, which was recognized by MDC as a significant positive benefit in its October 5, 1993 comments on the DSEIS/R. The new alternatives all provide a major improvement in the visual setting which contributes value to the parkland.

The differences among the Preferred Alternative and the other new alternatives are small compared with the difference between the Preferred Alternative and Scheme Z. The Preferred Alternative greatly reduces proximity impacts on Paul Revere Landing Park and the three parks upstream of the railroad crossing (the Nashua Street parkland, the Charles River Basin Recreation Area, and parkland at the former GSA site), by substantially reducing the height and mass of interchange and bridge elements, aligning ramps further from the river, and improving bridge design. The Preferred Alternative uses slightly more of the south bank portion of Paul Revere Landing Park than Scheme Z, but the MDC has indicated that notwithstanding this impact, the south portion of the park can be successfully developed as a landscaped plaza for recreation uses and will provide a suitable entry to the New Charles River Basin Park system. As noted above, the Preferred Alternative also expands Paul Revere Landing Park as a whole more than Scheme Z. Therefore, the Preferred Alternative minimizes harm to 4(f) parkland resources compared to Scheme Z.

Compared to Alternative 8.1D Mod 5, the Preferred Alternative uses slightly more land in Paul Revere Landing Park south of the river, but it expands the park north of the river to a greater extent than Alternative 8.1D Mod 5; the overall net increase in park area is nearly as great in the Preferred Alternative. Both alternatives provide for functionally equivalent design at Paul Revere Landing Park South in accordance with the MDC master plan. While there are differences in design between 8.1D Mod 5 and the Preferred Alternative (primarily, loop ramp design and Storrow Drive Connector Bridge), these structures are not located within 4(f) resource areas and the resulting differences are minimal as perceived by a park user in the upstream parks. At Leverett Circle/Storrow Drive, Alternative 8.1D Mod 5 has a similar surface reconfiguration of Leverett Circle but no eastbound boat section, resulting in substantially worse traffic congestion next to the Esplanade. Unlike the Preferred Alternative, in Alternative 8.1D Mod 5, there is a substantial period of construction disruption due to tunnel construction under the Nashua Street parcel (including a permanent subsurface easement), the Charles River Basin Recreation Area, and a corner of the park on the former GSA parcel.

The Preferred Alternative is identical to the Reduced River Tunnel Alternative in the south bank portion of Paul Revere Landing Park; the Preferred Alternative expands the north bank portion of the park by a greater amount. Although the Preferred Alternative has a Storrow Drive connector bridge, this bridge is not located within a 4(f) resource area and the bridge's alignment and profile make it blend visually into the background of the mainline bridge, and the two alternatives appear essentially the same as perceived by a park user in the upstream parks. The Reduced River Tunnel has a substantial period of construction disruption due to tunnel construction under the Nashua Street parcel (with permanent subsurface easement) and the designated Charles River recreation area; the Preferred Alternative avoids both temporary and permanent use of these parks.

The refinement to the Reduced River Tunnel Alternative, which was studied during preparation of this FSEIS/R, eliminates impacts to the upstream parks and is identical to the Preferred Alternative at Paul Revere Landing Park. As with the original Reduced River Tunnel Alternative, proximity impacts are essentially the same as the Preferred Alternative as perceived by a park user in the upstream parks.

Based on the functional equivalency of the new alternatives, their substantial similarity in proximity and other permanent impacts, and their expansion of Paul Revere Landing Park, the construction impacts of the Reduced River Tunnel Alternative and Alternative 8.1D Mod 5, and the latter alternative's greater traffic congestion next to the Esplanade, the Preferred Alternative minimizes harm to parklands compared to these alternatives. The refined version of the Reduced River Tunnel Alternative is very similar to the Preferred Alternative as it affects 4(f) Parklands, and does not reduce harm to a greater degree. As described above, the Preferred Alternative minimizes harm compared to Scheme Z. Accordingly, based on the analysis presented in this Section 4(f) Evaluation, the Preferred Alternative minimizes harm to Section 4(f) parkland resources, compared to Scheme Z and the other new alternatives.

3.8 MEASURES TO MINIMIZE HARM TO PARKLAND IN THE AREA NORTH OF CAUSEWAY STREET

As noted in the Project wide 1991 FSEIS/R Section 4(f) Evaluation, the Charles River crossing is a major feature in the Area North of Causeway Street, introducing highway structures where they are not currently present and requiring mitigation for a variety of environmental impacts, including minimization of harm to Section 4(f) properties. The 1991 Evaluation proposed a mitigation program serving the MDC's long-standing objective of improving the Charles River Basin as a part of the Metropolitan Park System, including the acquisition of significant park nodes and continuous pedestrian walkways on both sides of the river to link existing Charles River parklands with Boston Harbor. The 1991 Evaluation noted the progress to date toward this goal and stated that MHD will rely on the MDC to take a lead role in the detailed planning and design of mitigation measures and to assume ownership and control of new parklands when completed.

Key objectives in this context stated by the MDC are the completion of continuous pedestrian/bicycle and landscape connections from Lechmere Canal Park to Charlestown Navy Yard and from the Esplanade to the Boston Harborwalk. The individual park improvements in this area are to be viewed as components in a system making the transition from the parkland in the upper basin on the west to Boston Harbor on the east. Parkland in this area derives its value from the continuity of access to and along the Charles River, from views of the river, and from areas of passive use arranged along this path system. This transition area in the Charles River park system will have a unique character based on its setting and scale. The Nashua Street and GSA parcels will be nodes at the upstream end; Paul Revere Landing Park North and South will be nodes at the downstream end; pedestrian and bicycle connections between these nodes will be given high priority.

Among the mitigation measures identified for Scheme Z was the funding of the MDC parkland master plan, which has now been completed. The 1991 FSEIS/R also included a package of mitigation measures involving park improvements, based on discussions with the MDC. In general, these measures were related to the MDC's park development objectives for the area as a whole, reducing harm to individual parklands in a variety of ways by improving the system of major parklands in the area and providing or improving connections between them so that they could fulfill their function in the area-wide and regional Charles River park systems. In addition, several mitigation measures referred to improvements in the design of the highway structures so as to minimize harm through reduced impacts to the parkland resources.

In addition to parkland objectives, necessary mitigation for wetlands and waterways protected by federal and state statutes must also be located in this portion of the Charles River. This mitigation consists primarily of compensatory water surface area, theoretical flood storage volume, and bordering vegetated wetlands. In addition, the park improvements which serve to minimize harm to Section 4(f) resources also serve to provide public access to the Charles River, providing values recognized by the federal Clean Water Act and the Massachusetts Chapter 91 waterways regulations.

MHD has worked with the MDC and the State and Federal regulatory agencies to develop a coherent mitigation program specific to the impacts of the Preferred Alternative. MDC has concurred that this mitigation program and associated implementation measures included in the 1993 MOA adequately and appropriately address the impacts of the Preferred Alternative and the achievement of key park objectives for development of this portion of the Charles River Reservation. This mitigation program is consistent with the MDC's Master Plan and represents all possible planning to minimize harm to the Section 4(f) resources affected by the Charles River Crossing. This mitigation program is presented in Chapter 6 of this FSEIS/R. Provisions relevant to Section 4(f) parklands are listed below. Generalized phasing is indicated relative to commencement of Project construction.

The list of mitigation measures includes a series of park improvements, pedestrian connections, and wetlands and waterways mitigation, organized in a manner consistent with the MDC Master Plan to facilitate implementation.

The following performance standards have been incorporated in the 1993 MOA between MHD and the MDC, and apply to the fulfillment of these measures. The locations of the mitigation measures are shown in Figure 9. For reference purposes the MDC draft Master Plan for this area is shown in Figure 10.

For each landscaped area intended for public recreational use, the level of quality that is to be achieved shall be typical of other recently completed parks in the Charles River basin, such as Lechmere Canal, Front Park, Kennedy Park, and the historic work of the original Storrow Memorial Embankment (the Esplanade). Pedestrian and bicycle access shall be continuous along both banks of the river, shall meet all applicable guidelines for accessibility, and shall provide for separation of pedestrians and bicycles where possible. Path widths shall be adequate for anticipated use, with a minimum width of 10-12 feet for principal paths. "Landscaping" shall encompass site preparation, utility relocations, and all work necessary to address structural issues, including seawalls, banks, and decks.

Mitigation measures addressing all Section 4(f) parkland impacts, are as follows:

1. Paul Revere Landing Park South bank portion, including landscaped corridor providing pedestrian/bicycle and service vehicle access from Causeway Street, landscaped path connection on the south bank of the Charles River, connecting to the concrete walkway on the MBTA trestle, and provision of a new pedestrian/bicycle connection over the MBTA railroad tracks to the Spaulding Hospital site. (MDC Master Plan designation: Revere Plaza)

1.1 Improve park.

1.2 Improve corridor south to Causeway Street.

1.3 Connect riverside walkway to south trestle walkway.

1.4 Provide south bank railroad overpass for pedestrians/bicycles.

Approximate area of improvement: 2.1 acres, excluding banks. Phasing: Post-Project construction

2. Lovejoy Wharf Park, including a pedestrian/bicycle underpass and connection to the North Washington Street Bridge sidewalk.

2.1 Acquire wharf property.

2.2 Demolish existing timber wharf and timber piles.

2.3 Reconstruct wharf.

2.4 Improve wharf as a park with walkway.

2.5 Provide Lovejoy Wharf/North End Park walkway underpass, with access to North Washington Street bridge.

Approximate area of improvement: 0.8 acre. Phasing: Pre-Project construction

3. Leverett Circle/Storrow Drive: areas affected by reconfiguration of intersection and new vehicular underpass.

3.1 Improve green spaces and edges.

3.2 Provide appropriate architectural treatment to underpass and boat section facade.

3.3 Provide new pedestrian overpass between Leverett Circle/Science Park MBTA Station and Nashua Street Park.

Approximate area of improvement: 0.9 acre. Phasing: post-Project construction.

4. Paul Revere Landing Park North, including a pedestrian/bicycle underpass to Tudor Wharf. (MDC Master Plan designation: Charlestown Meadows East)

4.1 Improve park.

4.2 Provide Tudor Wharf/Revere North walkway underpass.

Approximate area of improvement: 4.6 acres. Phasing: Pre-Project construction.

5. **North bank of the Charles River** extending Paul Revere Landing Park westerly to the MBTA rail road right of way, including the Millers River area and a pedestrian/bicycle path connecting to Rutherford Avenue via the new roadway intersection. The improved area extends from the Charles River to the first at-grade/boat section highway ramp. This measure includes a pedestrian/bicycle overpass connection over the MBTA railroad tracks to North Point East and walkways on both sides of the MBTA bascule bridge connecting to the existing walkways on the south bank of the river. (Master Plan designation: Charlestown Meadows West)

5.1 Construct walkway over MBTA railroad tracks to connect with North Point East Park.

5.2 Improve park.

5.3 Provide walkway from Rutherford Avenue to Charles River alongside Millers River.

5.4 [intentionally omitted]

5.5 Construct walkways on either side of MBTA bascule bridge, north half.

Approximate area of improvement: 6.0 acres. Phasing: Post-Project construction.

6. **Highway infield Parcel on Rutherford Avenue***, providing a visual buffer. (This parcel is not intended for public access but improves the setting of the path along Rutherford Avenue to Paul Revere Landing Park.)

6.1 Improve infield area.

Approximate area of improvement: 2.0 acres. Phasing: Pre-Project construction.

7. **Nashua Street Park** extending from O'Brien Highway to the edge of the MBTA railroad right of way, including the Spaulding walkway and the waterfront portion of Spaulding Hospital site, extending at least 100 feet from the water's edge. (Master Plan designation: Nashua Meadows)

7.1 Improve parks.

7.2 Improve waterfront portion of Spaulding Rehabilitation Hospital site, with a minimum 100 foot depth (0.6+/- acres).

7.3 Rehabilitate shoreline to permit park use.

7.4 Remove pilings from watersheet (subject to review of issue with owner).

Approximate area of improvement: 2.6 acres, including 0.6 on Spaulding site. Phasing: Nashua Street parcel: Pre-CA/T construction. Spaulding site: Post-Project construction

8. **North bank of the Charles River** from the MBTA right of way to the boundary of the MDC Central Services Parcel (former GSA parcel), and extending from the river to the proposed roadway in North Point and to the highway loop ramps. A portion of this area may be developed as a water feature with bordering vegetated wetlands. (Master Plan designation: North Point East)

8.1 Acquire land.

8.2 Improve park.

8.3 Remove existing railroad trestle (subject to review of issue with owner).

8.4 Rehabilitate shoreline .

8.5 Remediate contaminated/hazardous soils, as necessary.

8.6 Provide new water feature, incorporating bor dering vegetated wetlands.

Approximate area of improvement: 2.1 acres, excluding water feature. Phasing: Pre-Project construction.

9. **Banks of the Charles River**, including MDC Central Services parcel (formerly the GSA parcel), extending to O'Brien Highway and to the proposed roadway in North Point. A portion of this area may be developed as a water feature with bordering vegetated wetlands. (Master Plan designation: North Point West)

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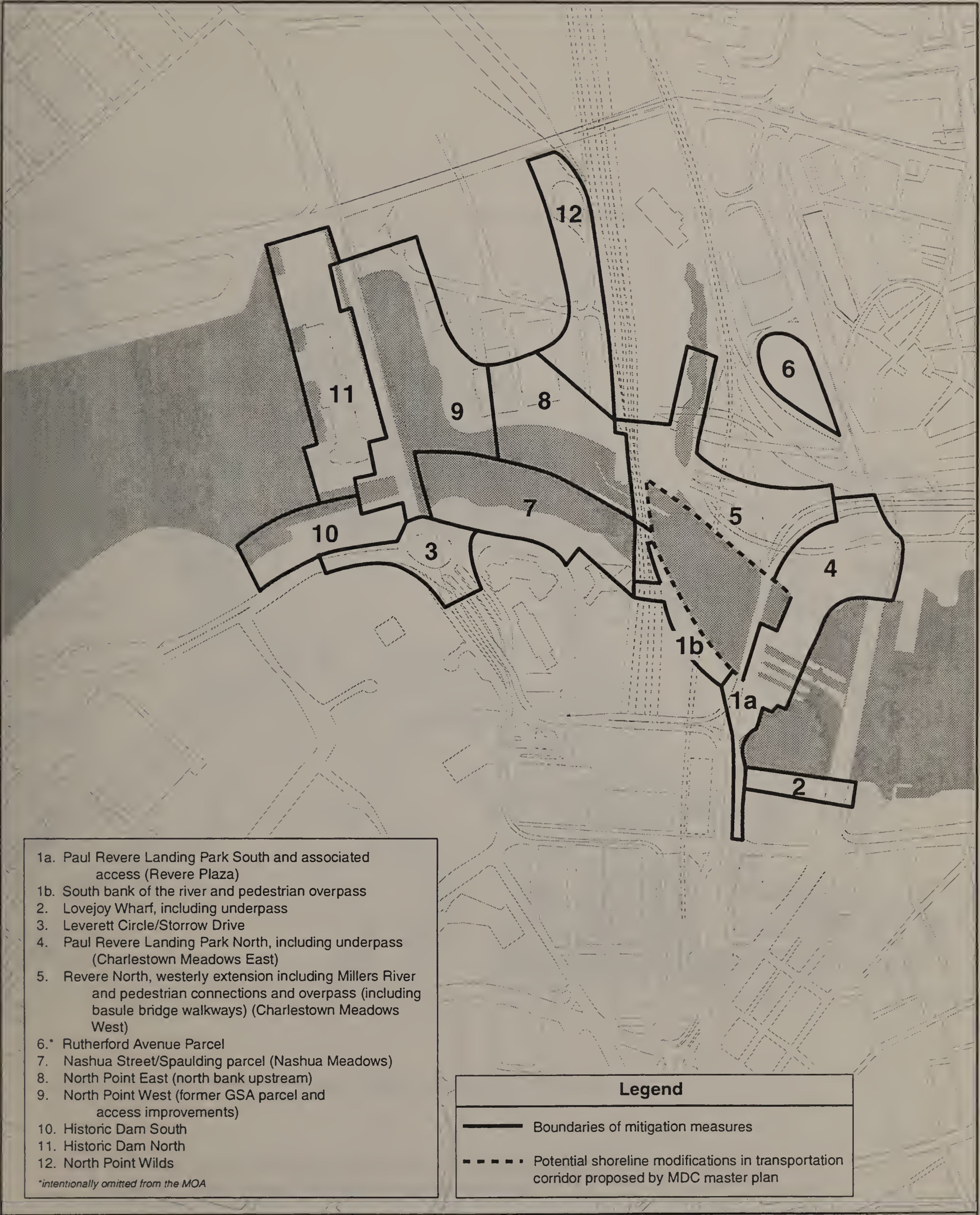
* This measure is intentionally omitted from the 1993 MOA. It will proceed pursuant to the Chapter 91 license for the CANA Temporary Loop Ramps.



1a. Paul Revere Landing Park South and associated access (Revere Plaza)
1b. South bank of the river and pedestrian overpass
2. Lovejoy Wharf, including underpass
3. Leverett Circle/Storrow Drive
4. Paul Revere Landing Park North, including underpass (Charlestown Meadows East)
5. Revere North, westerly extension including Millers River and pedestrian connections and overpass (including basule bridge walkways) (Charlestown Meadows West)
6.* Rutherford Avenue Parcel
7. Nashua Street/Spaulding parcel (Nashua Meadows)
8. North Point East (north bank upstream)
9. North Point West (former GSA parcel and access improvements)
10. Historic Dam South
11. Historic Dam North
12. North Point Wilds

intentionally omitted from the MOA

Legend

▬▬	Boundaries of mitigation measures
- - - -	Potential shoreline modifications in transportation corridor proposed by MDC master plan

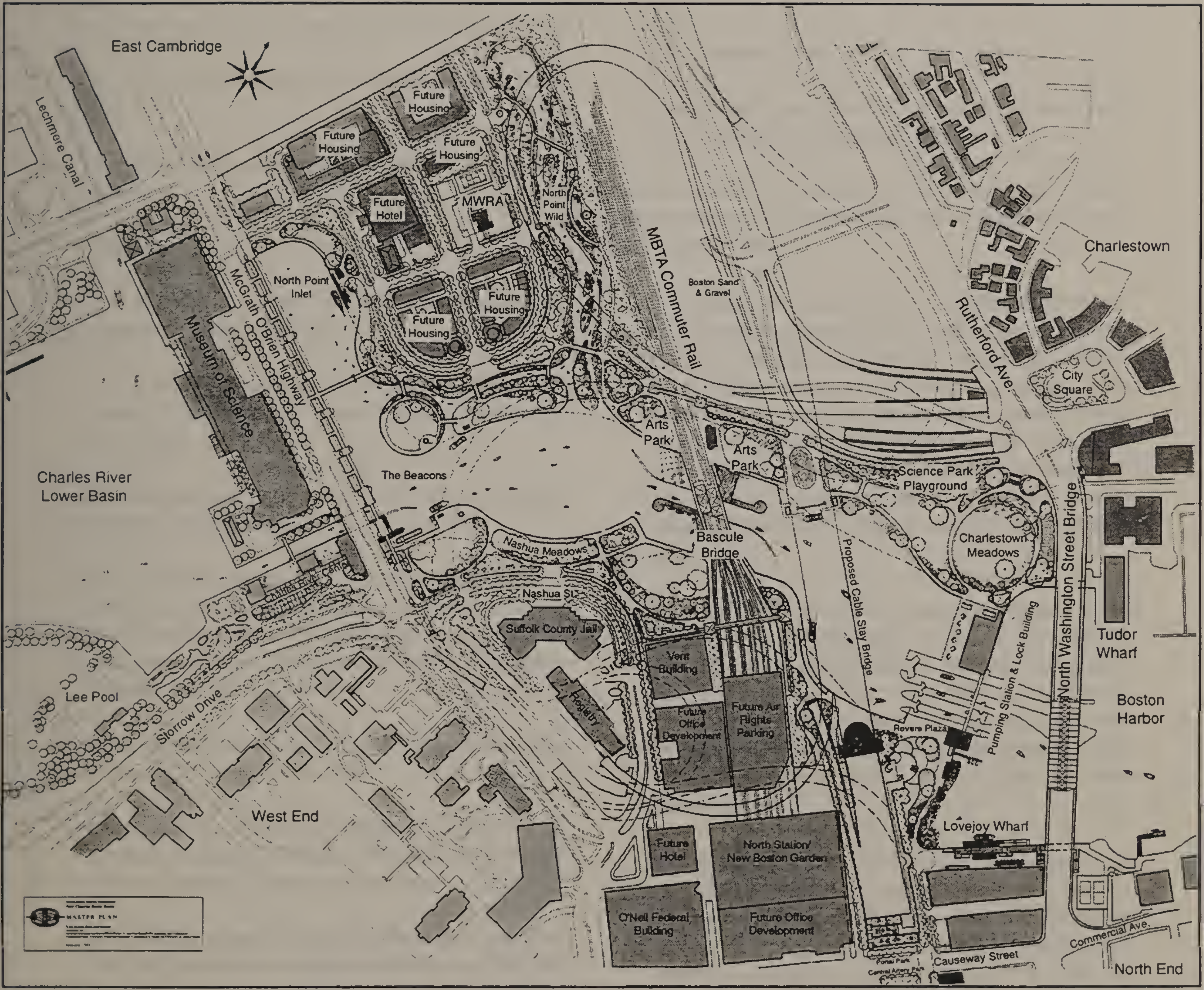
FIGURE

9

Location of Mitigation Measures

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT


East Cambridge
Lechmere Canal
Future Housing
Future Housing
Future Housing
Future Hotel
MWRA
North Point Wild
North Point Inlet
Future Housing
Future Housing
MBTA Commuter Rail
Boston Sand & Gravel
Charlestown
Rutherford Ave
City Square
McGrath O'Brien Highway
Museum of Science
Charles River Lower Basin
The Beacons
Arts Park
Arts Park
Science Park Playground
Bascule Bridge
Charlestown Meadows
North Washington Street Bridge
Nashua Meadows
Nashua St.
Suffolk County Jail
Vent Building
Registry
Proposed Cable Stay Bridge
Pumping Station & Lock Building
Tudor Wharf
Boston Harbor
Lee Pool
Storrow Drive
Future Office Development
Future Air Rights Parking
Revere Plaza
West End
Lovejoy Wharf
Future Hotel
North Station/ New Boston Garden
O'Neil Federal Building
Future Office Development
Portal Park
Central Artery Park
Causeway Street
Commercial Ave.
North End
MASTER PLAN

Source: Metropolitan District Commission, August 1993 Draft Parkland Master Plan

Note: MDC Plan was prepared based on Alternative 8.1D Mod 5 featured in MHD's September 1992 Notice of Project Change. Modification to accommodate the Preferred Alternative will be incorporated.

FIGURE

10

1993 MDC Draft Parkland Master Plan For New Charles River Basin

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY (I-93)/TUNNEL (I-90) PROJECT

9.1 Acquire land for relocation of the MDC Central Services facility.

9.2 Replace MDC Central Services facility.

9.3 Demolish existing MDC Central Services facility.

9.4 Remediate contaminated/hazardous soils if necessary.

9.5 Improve park.

9.6 Provide new water feature, incorporating bordering vegetated wetlands.

9.7 Provide pedestrian access improvements between North Point Park and Historic Dam North and South.

Approximate area of improvement: 2.9 acres. Phasing: Pre-Project construction.

10. MDC property at the historic dam south of the lock, extending from O'Brien Highway up stream to the point where the embankment widens, and including historic structures. (Master Plan designation: Historic Dam South)

10.1 Improve area and upgrade associated structures to the extent practicable.

Approximate area of improvement: 3.1 acres, including structures. Phasing: Pre-Project construction and during Project construction.

11. MDC property at the historic dam north of the lock, accessible to the public outside of the Museum of Science, including historic structures .(Master Plan designation: Historic Dam North)

11.1 Improve area and upgrade associated structures to extent practicable.

Approximate area of improvement: 1.6 acres, including structures. Phasing: Pre-Project construction and during Project construction.

12. Area generally lying between the proposed roadway in North Point and the MBTA railroad right of way, and extending from the highway loop ramps north to the Gilmore Bridge. (Master Plan designation: North Point Wilds)

12.1 Improve area.

Approximate area of improvement: 6.3 acres. Phasing: During Project construction.

In addition, the following design refinements in the highway structures are proposed to reduce impacts to Section 4(f) parkland:

- Bridge and ramp design: further refinements will be made to maximize the clearance under the bridge at Paul Revere Landing Park South. Structural design, placement of columns, lighting, and architectural treatment of perimeter facade, abutment walls, underside, and columns will be done so as to be as compatible as possible with park and pedestrian improvements and to present an acceptable appearance to abutting communities and land uses.

- Special effort will be given to the design of the under-bridge environment at Paul Revere Landing Park South, including special lighting, and appropriate uses to make the area under the bridge as positive as possible. Lowering existing ground level by 2 to 4 feet would provide greater headroom and permit the abutment wall to be moved further from the riverbank.

- Special attention will be given to the design and location of bridge piers and appurtenances such as fender piers, escape stairs, and other structures that occupy or are visible from parkland. Pile-supported shoreline extensions will be explored in terms of design and environmental considerations in order to avoid unattractive backwaters between bridge piers or fenders and the existing shoreline, or in order to facilitate safe and attractive pedestrian and bicycle access along the shoreline. Designed in coordination with state and federal permitting agencies, these minor modifications to the shoreline can potentially provide public access to the water which mitigates their impact under the various water resource regulations.

MHD will continue to work with the MDC to implement the 1993 MOA. While MHD recognizes and endorses the general concepts of the master plan as reflecting the MDC's park objectives for this area, in accordance with the revised MOA, specific elements of park design will be developed by the MDC. The MDC will be responsible for resolving those environmental permitting implications of measures which represent additional enhancement beyond the performance standards specified in the 1993 MOA. MHD will cooperate with the MDC, the cities of Boston and Cambridge, and the permitting agencies in addressing such questions as they affect properties under MHD's control during construction. As provided in the MOA, the MDC will generally be responsible for the design, environmental permitting, and construction of those mitigation improvements which are funded by MHD but are located outside the Project work limits.

Construction Period Mitigation. MHD's objective is to minimize disruption and maintain continuous navigation through the locks and pedestrian access over the locks during construction, as well as continuous pedestrian access to the Esplanade. Preliminary staging plans for both designs are presented in Chapter 5 of this FSEIS/R. Further effort since the DSEIS/R has resulted in slightly more detailed preliminary construction staging plans for the Preferred Alternative. They are presented in the Supportive Engineering Report appended to this FSEIS/R. The pre-mainline mitigation improvements planned with the MDC are being coordinated with these construction staging plans to avoid or minimize disturbance to these early park improvements.

3.9 BUNKER HILL COMMUNITY COLLEGE ATHLETIC FACILITIES

Scheme Z And New Design Alternatives. Scheme Z does not extend onto BHCC property. The three new alternatives analyzed in the DSEIS have an identical northbound off-ramp to Rutherford Avenue. This ramp crosses the property on viaduct, passes between the College's tennis courts and ball fields, reaches local ground level near the softball field, and descends to Rutherford Avenue, at an elevation approximately 10 feet below the level of the ball fields. In the Preferred Alternative, this ramp has been relocated to Cambridge Street in Sullivan Square, avoiding all 4(f) resources.

Description Of Section 4(f) Property. The athletic facilities at the north end of the campus comprise approximately 9 acres and include a baseball field and a softball field surrounded by an asphalt jogging path, and four tennis courts. The baseball field and softball field are oriented in opposite directions, with home plates approximately 720 feet apart and a large common outfield area. A soccer field is located in the common outfield area between the ball fields. The jogging path is 8 feet wide and approximately 2,200 feet in length. These facilities are intended to be used by BHCC students and staff, although, according to college administrators, community use of ball fields and tennis courts is permitted, and some use occurs. The setting of the athletic facilities includes the BHCC academic buildings to the south, the I-93 viaduct to the west, an industrial area to the north, and Rutherford Avenue and the edge of the Charlestown community to the east.

Impacts On The Section 4(f) Property. The Preferred Alternative has no impacts on the BHCC athletic fields, as ramp C-L has been relocated to Sullivan Square. (This ramp was common to all new alternatives and the relocation to Sullivan Square could also apply to the other alternatives.) There will be no proximity impacts from the I-93 mainline, which will be no closer than the existing I-93 and similar in configuration, or from the new collector-distributor roadway located beyond the mainline. No land from BHCC will be used during construction and there will be no construction disruption to the use of the facilities.

Avoidance Alternatives. The Draft Section 4(f) Evaluation discussed a number of potential avoidance alternatives including elimination of the ramp or its relocation at City Square, elsewhere on Rutherford Avenue, or at Sullivan Square. Further analysis has indicated that the Sullivan Square location is feasible, and the Preferred Alternative contains this refinement, avoiding the Bunker Hill Community College property.

Conclusion. Based on the above, there is no use or temporary use of the Bunker Hill Community College athletic fields.

4 HISTORIC RESOURCES

This section addresses historic resources protected by Section 4(f) which are used by Scheme Z, the Preferred

Alternative, or one of the other new alternatives. Section 4(f) protects buildings that are listed or eligible to be listed on the National Register of Historic Places, and contributing buildings or land within historic districts that are listed or eligible for listing. This Section 4(f) Evaluation addresses a narrower range of issues than the assessment presented in Section 4.7.1 of this FSEIS/R, where all effects on historic resources are considered. Section 4(f) requires specific analysis and findings by FHWA where there is actual use of a historic resource or adverse effects sufficiently serious to substantially impair the values and attributes of the resource (i.e., constructive use).

Scheme Z uses portions of three resources: land within the Charles River Basin Historic District, Railroad Signal Tower A, and (temporarily) the granite seawalls along the Charles River under its I-93 bridges. (The seawalls in this area were identified for the first time as eligible for listing by MHC in the months preceding the publication of this DSEIS/R.) Three other resources were documented in the 1991 Section 4(f) evaluation as not being used by Scheme Z: the Causeway/North Washington Streets Historic District, Charles River Railroad Drawbridge, and Town Hill Historic District.

One or more of the new alternatives use four resources: land within the Charles River Basin Historic District, railroad signal Tower A, the Registry of Motor Vehicles building (underpinning), and (temporarily) the granite seawalls along the Charles River. For continuity, the Causeway/North Washington Streets Historic District, Charles River Railroad Drawbridge, and the Town Hill Historic District are briefly addressed in this Section 4(f) Evaluation, as well as the North End Historic District, in which there is a brief temporary disturbance and restoration of historic pavement at Stillman Place by all new alternatives.

In all cases, the 1984 Section 106 MOA, signed by FHWA, MHC, Boston Landmarks Commission, and MHD, provides for review of design and construction plans by the Project Conservator to ensure that potentially adverse construction impacts on historic resources are minimized or avoided. The situations involved in the Charles River Crossing are similar to those found elsewhere in the CA/T Project and covered by the existing MOA. For this reason, no amendment or new MOA is planned. Rather the current guidelines, procedures, and ongoing coordination with the MHC, BLC, Cambridge Historical Commission, and CA/T Project Conservator will continue to be used to minimize or avoid harm to the resources described below. Future coordination with MHC is discussed in their letter, dated January 21, 1994, which is appended.

Section 4(f) also protects archaeological resources eligible for listing on the National Register. Most of the area affected by the Preferred Alternative and other new alternatives had previously been surveyed for potential archaeological resources. Additional survey was necessary in the area north of Gilmore Bridge. A Phase I reconnaissance survey was submitted to MHC on October 7, 1993. The MHC letter dated December 9, 1993, acknowledges receipt of this survey and concurs in the process outlined for ongoing coordination regarding archaeological resources.

Preliminary archaeological research (as described in Section 4.7.2 of this FSEIS/R) has identified three areas affected by the Preferred Alternative and the other new alternatives for the Charles River Crossing as potentially possessing archaeological resources. Archaeological monitoring of new soil borings and geotechnical analyses and continued consultation with the SHPO pursuant to the Section 106 MOA will be undertaken as final design proceeds, in order to determine the need for further archaeological investigations, if any. If further study confirms the existence of archaeological resources at locations that will be distrubed, and if such resources are identified as eligible for listing on the National Register, appropriate consultation with the SHPO regarding plans for avoidance, preservation, or data recovery and other findings, if necessary, will be completed.

Locations of resources described above are shown in Figure 11.

4.1 CHARLES RIVER BASIN DISTRICT

Scheme Z And New Design Alternatives. In Scheme Z and all three new alternatives, Leverett Circle its reconfigured, and in all alternatives except 8.1D Mod 5, the easterly curb line of Storrow Drive is moved outward. (The Reduced River Tunnel Alternative has been refined since the DSEIS/R, and this refined version has substantially the same design as the Preferred Alternative within the district.) Also, the existing surface lanes continue to pass under the first arch span of the historic Streetcar Railway Viaduct, and one proposed lane passes under the station.

Description Of The Section 4(f) Property. The Charles River Basin National Register District incorporates the Charles River and the parkways and landscaped areas on both banks for approximately 6 miles upstream from the old Charles River dam (carrying the O'Brien Highway) to the Eliot Bridge in Cambridge. Owned and maintained by the MDC, its significance is based on the history of metropolitan park planning and land reclamation in the Charles River Basin, as well as the architectural merit of several features. The contributing elements of the district which are within or adjacent to the Project area include the Esplanade (recreation), the old Charles River dam (land reclamation), the Police Headquarters and Lock houses (relationship to the dam and architectural merit), and architecturally significant Street Railway Viaduct (carrying the MBTA Green Line). Storrow Drive and Leverett Circle, also lying within the district, are described as physical features of the district in the National Register nomination, but not mentioned in its discussion of the district's significance. (Leverett Circle Storrow Drive, and the Esplanade are also discussed in the Parkland section of this Section 4(f) Evaluation.)

Impacts On The Section 4(f) Property. In Scheme Z, a total of 0.57 acre of land is converted from roadway to landscaping or from landscaping to roadway as part of the redesign of the Leverett Circle intersection and the widening of Storrow Drive on the opposite side from the Esplanade. These changes do not affect the contributing features of the district, such as the Street Railway Viaduct and historic buildings at the dam, and do not change its visual character.

The Preferred Alternative and other new alternatives affect the district in the same manner as Scheme Z, using varying amounts of land. None permanently affects contributing features within the district. Alternative 8.1.D Mod 5 has no eastbound underpass at Leverett Circle and therefore does not change in the southeast curb line of Storrow Drive; it changes a total of 0.42 acre of pavement to landscaping or landscaping to pavement. The refined Reduced River-Tunnel and Preferred Alternative have similar eastbound underpasses to Scheme Z and widen Storrow Drive by the same amount as Scheme Z. Total use of land in the district is 0.63 acre in the Reduced River Tunnel-Alternative and 0.59 acre in the Preferred Alternative. (The above figures include the total of areas changed by the alternatives, whether converted to pavement or to landscaping.) Although there are differences among these alternatives in the presence or absence of an eastbound underpass and its configuration, these differences do not affect the historic attributes and values of the district, as Storrow Drive and Leverett Circle are not contributing features. (Refer to the section on Leverett Circle/Storrow Drive in the Parkland section of this Section 4(f) analysis).

As described above under Parklands and in more detail in Section 4.4 of this DSEIS/R, changes in year 2010 noise and air quality among the alternatives are small, and the contributing features of this part of the district are not particularly sensitive to these impacts. The projected changes in noise and air quality do not substantially impair or diminish the attributes of the district's contributing features in any alternative.

Alternative 8.1D Mod 5 involves construction of a tunnel connection near the first arch of the historic Street Railway Viaduct. No impacts are anticipated, as this construction procedure is properly planned and controlled under the supervision of the Project Conservator. In accordance with the provisions of the 1984 Section 106 MOA, temporary construction impacts are similarly controlled and minimized in the other alternatives through further study during design development under the supervision of the Project Conservator. All construction work takes place outside the Esplanade.

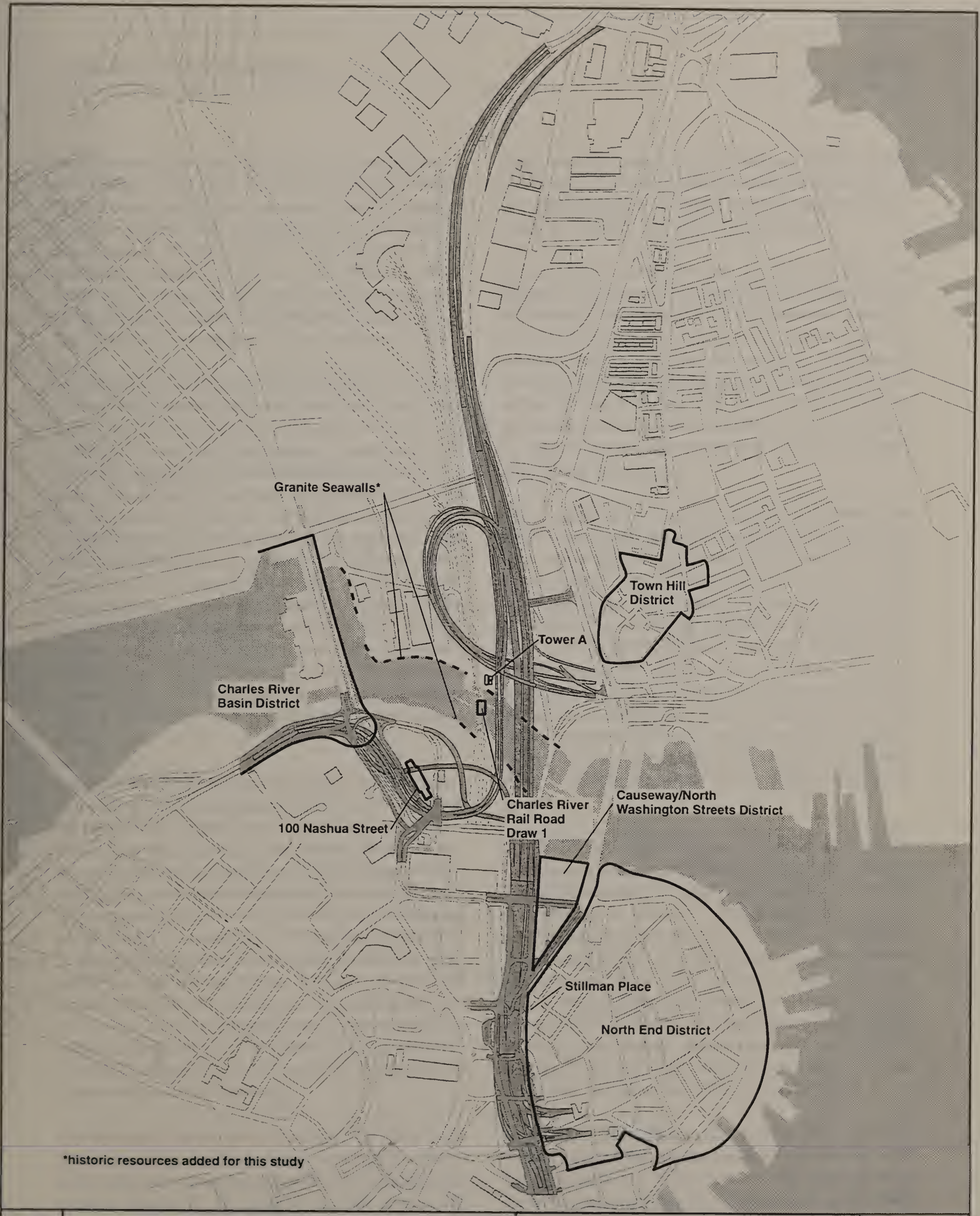
Avoidance Alternatives. As discussed in the 1991 Section 4(f) Evaluation, connection to Storrow Drive is a principal design objective of the Project; therefore, use of this MDC property, which lies within the district, cannot be avoided. However, there is no long-term adverse effect on the historic district.

Measures To Minimize Harm. Construction near the historic Street Railway Viaduct will be carefully reviewed under the Section 106 MOA. Any potential adverse effects from construction are mitigated through review of design and construction specifications by the Project Conservator.

Conclusion. Based on the above, there is no feasible and prudent alternative to use of land from the Charles River Basin Historic District. The Preferred Alternative includes all possible planning to minimize harm to this district resulting from such use.

4.2 TOWER A

Scheme Z And New Design Alternatives. Scheme Z has loop ramps directly over Tower A and a double-


Granite Seawalls*
Town Hill District
Tower A
Charles River Basin District
Charles River Rail Road Draw 1
Causeway/North Washington Streets District
100 Nashua Street
Stillman Place
North End District
0
600
1400 FEET

*historic resources added for this study

FIGURE

11

Historic Resources Addressed Section 4(f) Evaluation

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

deck Storrow Drive connector bridge in the vicinity of the building. Alternative 8.1D Mod 5 and the Reduced River-Tunnel Alternative have tunnels near the building but have reduced loop ramps located 35 feet away in Alternative 8.1D Mod 5 and 85 feet away in the Reduced River-Tunnel Alternative. The Preferred Alternative has no tunnel in the vicinity; its loop ramps and its single-deck Storrow Drive connector bridge are 35 and 70 feet away from the building, respectively.

Description Of The Section 4(f) Property. Tower A is a two-story, rectangular steel frame and brick signal tower with full-story brick and copper five-sided bays on the north and south elevations. A one-story brick flat-roofed addition runs the full width of the east elevation. The structure was built during the Boston and Maine Railroad's 1926-32 construction of the Boston Engine Terminal and replaced an earlier structure on the south side of the railroad bridges. It was placed in service in 1931. It is equipped with an electrical board with 211 levers. Tower A is considered eligible for listing on the National Register as a distinctive example of railroad architecture. It is the only remaining unaltered building from the B&M expansion of the Boston Engine Terminal. It is also significant for the signal technology used in the tower. Tower A serves the same function today.

Impacts On The Section 4(f) Property. In Scheme Z, overhead CANA ramps pass within 2 to 4 feet above the roof of the building, and a line of columns blocks views from the building to the railroad tracks. Thus, the setting of the building is drastically altered, and the relationship between the building and the railroad tracks, which is an attribute central to the historic significance of the building, is destroyed. (At the time of the 1991 Section 4(f) Evaluation it was uncertain whether foundation construction for Scheme Z would adversely affect the building structurally; it is now concluded that this is not the case, although some impacts requiring mitigation might occur.) For these reasons, the 1991 Section 4(f) Evaluation concluded that the building is permanently used by Scheme Z.

The Preferred Alternative and other new alternatives avoid direct use of the building exterior and would substantially reduce the visual impacts to Tower A's setting compared to Scheme Z. As noted in the 1991 Section 4(f) Evaluation, there is potential for reuse of the building for park-related function such as a transportation exhibit should its use as an active railroad facility be discontinued. The MDC Master Plan includes this type of use, and the new alternatives provide opportunities to make the building accessible to park users.

Alternative 8.1D Mod 5 removes the CANA project ramp impact by eliminating the outer loop ramp; the remaining viaduct loop leading to I-93 southbound (Ramp T-C) is 85 feet from Tower A, and the closest supporting column would be 100 feet to the north. The tunnel leading to I-93 northbound (Ramps C-T and S-N) passes within 15 feet of the building, and an exhaust duct for the tunnel passes under the northeast corner of Tower A, requiring permanent subsurface use and underpinning during construction.

The Reduced River-Tunnel Alternative eliminates the CANA project ramp impact by relocating the viaduct loop connecting I-93 northbound and Route 1 northbound (Ramp C-T) 35 feet away from Tower A. Columns supporting the highway viaducts are located 15 feet east of the rear of the building; four others are located north, 90 to 150 feet away, near the railroad tracks. These viaducts and columns have substantially less impact than Scheme Z and have little effect on the Tower's setting and relationship to the railroad tracks. As refined, the tunnel leading to Route 1 northbound (Ramp S-N) is located 160 feet from this building. Therefore, there is no subsurface use and no underpinning is required.

The Preferred Alternative eliminates this CANA project ramp impact in the same manner as in the Reduced River-Tunnel Alternative. A single-deck Storrow Drive connector bridge is located 70 feet downstream from the building and does not affect the Tower's relationship to the railroad tracks. A column supporting the Storrow Drive connection highway viaduct is located 100 feet east of the building; three others are located 65 to 85 feet north of the building, near the railroad tracks. These viaducts and columns are substantially reduced from Scheme Z and have little effect on the Tower's setting. Therefore, no use of the resource would occur.

Avoidance Alternatives. The refined Reduced River-Tunnel Alternative and the Preferred Alternative avoid any permanent use of the resource and reduce changes in the building's setting and sightlines to the point where no constructive use occurs.

Measures To Minimize Harm. Potential adverse effects due to construction will be mitigated through review of the design and construction specifications by the Project Conservator.

Conclusion. Based on the above, the Preferred Alternative avoids any use of Railroad Signal Tower A.

4.3 GRANITE SEAWALLS IN THE LOWER BASIN OF THE CHARLES RIVER

Scheme Z And New Design Alternatives. Scheme Z and all three new alternatives have bridges over or near portions of granite seawall on the north and south banks of the Charles River, downstream from the railroad crossing. Construction of large footings for these bridges would temporarily disrupt these seawalls in the immediate vicinity. Alternative 8.1D Mod 5 and the original version of the Reduced River Tunnel Alternative each have a river tunnel passing under the seawall on the Cambridge side of the river upstream of the railroad crossing. The realigned Reduced River Tunnel Alternative passes under the seawall on the south bank of the river, downstream from the railroad crossing. In all three new alternatives, a short section of seawall may be permanently altered to accommodate a required water feature.

Description Of The Section 4(f) Property. There are several lengths of granite seawall between the Charles River dams. Although some portions of these seawalls are affected by Scheme Z, they were only recently identified as potentially eligible for the National Register. MHC has determined that the seawalls in this area are National Register eligible. These resources include a nearly continuous granite seawall on the northern (Cambridge) side of the river, which extends from the Railway Viaduct to the dam, and fragments of a granite seawall on the southern edge of the river, near the North Station platforms and Spaulding Hospital and on the northern edge of the river between the railroad crossing and the new dam. Although these seawalls were not included in the Charles River Basin District, they are believed to be similar to features in that district though of later date. Some portions of the seawall have collapsed and there is incomplete evidence from the MDC master planning process that the walls may be structurally unsound. The walls are supported on wooden platforms and pilings which may have deteriorated, a process accelerated by the change from a salt water regime to fresh water with the completion of the new MDC dam in 1978.

Impacts On The Section 4(f) Property. Scheme Z and all new alternatives would require the reconstruction of a portion of seawall on the north bank near the outlet of the Millers River in order to construct a footing for their respective highway bridges. Scheme Z, the Reduced River-Tunnel Alternative, and the Preferred Alternative require reconstruction of a portion of seawall just upstream of Paul Revere Landing Park on the south bank for the same purpose. In all instances, less than 100 lf of seawall are dismantled, and construction of footings and cofferdams at the riverbank occurs; temporary construction structures are then removed and the seawall blocks replaced in their existing condition. There is no long-term impact on the seawalls due to bridge piers. Therefore, temporary use of the granite seawalls occurs in all alternatives, including Scheme Z.

In addition, in Alternative 8.1D Mod 5 and the original version of the Reduced River Tunnel Alternative, construction of the river tunnel requires temporary removal of a portion of the granite seawall located on the north side of the river, between the railroad bridge and the Street Railway Viaduct. Following construction, the seawall can be reconstructed in place in its existing condition. Alternative 8.1D Mod 5 crosses the seawall at an acute angle affecting 250 lf. The original version of the Reduced River Tunnel Alternative affects 150 lf of north bank seawall just upstream from the railroad crossing in the same manner. The refined version of the Reduced River Tunnel Alternative passes under a section of seawall on the south bank of the river immediately downstream of the railroad crossing. Approximately 100 linear feet of seawall would be temporarily removed during construction and then replaced.

In all alternatives, State and Federal wetland and waterways regulations will require mitigation for impacts of the Charles River Crossing on the Charles and Millers Rivers. For the three new alternatives this mitigation will require the creation of additional water features providing compensatory water surface area, flood storage, and bordering vegetated wetlands in the vicinity of the sites of impact, i.e., along the Charles River between the dams. Mitigation for Section 4(f) parkland impacts includes MHD funding of waterfront park improvements on the GSA parcel and North Point waterfront, which are bounded by the historic seawalls. Although a full structural evaluation has not been done, it appears that for safety reasons the park improvements may require the modification, repair or reconstruction of some or all portions of the seawalls.

As discussed in Section 3.8 above, MHD is working with the regulatory agencies and the MDC to design the required mitigation in a manner that meets regulatory requirements while minimizing harm to Section 4(f) parklands. Although the final configuration of the required water features will not be known until the conclusion of the permitting processes, potential impacts of the mitigation to 4(f) resources are described here.

DEP has indicated that under applicable waterways regulation the new water feature will be required to connect to the Charles River at both ends to permit navigation, involving the permanent opening in a portion of the granite seawall. (The second opening required for the navigable water feature is planned at a location where the historic seawall has already collapsed.) Portions of seawall to be opened would be relatively short, on the order of 50 linear feet compared to a total of over 2,400 linear feet of existing seawall between the dams. The opening in the wall would be designed in a historically appropriate manner. Future design could include investigation of such options as an underpass which retains the vertical configuration of the existing sea wall to the maximum extent possible and provides for pedestrian passage over the water feature. In addition, a portion of the south bank of the Charles River may be reconfigured. This would involve temporary removal of a portion of the seawall, excavation of soil from the bank, and reconstruction of the seawall 20 to 40 feet inland of its original location. In addition, as discussed above, an undetermined portion of the seawalls may require modification, repair, or reconstruction to address structural problems. Overall, these effects on the seawalls will be offset by increased public access to the area and potentially, by the remediation of structural problems.

Consultation is ongoing with MHC, Boston Landmarks Commission, and Cambridge Historical Commission regarding the potential impacts and potential improvements to the seawalls in connection with the mitigation program.

Avoidance Alternatives. Because the alignment of I-93 is highly constrained, and because it is necessary to avoid placement of piers in the river where they interfere with navigation, it is not possible to avoid temporary use of short portions of seawall near the bridge piers during their construction.

Likewise, although wetland and waterways impacts requiring mitigation have been minimized under the applicable regulations (see Section 4.5.5 of this FSEIS/R), mitigation in the form of a new water feature consistent with parkland development will be required. As the granite seawalls are located throughout the project area, where the wetlands mitigation must also be located, there are few avoidance opportunities that are consistent with planned park use on property protected by Section 4(f). The extent of required wetlands mitigation is the same for all alternatives, and requirements for direct connections to the Charles River through an opening in the seawall would also apply to Scheme Z. Opportunities will be explored to locate water features at segments of shoreline where the existing walls are already breached, or at locations where the walls have been rebuilt (as for example at the site of the Orange Line tunnel crossing), or at locations where the seawall is already in poor structural condition. Similarly, access to the waterfront is a basic value of the Section 4(f) parkland in this area, and it may not be possible to provide this access safely without some disturbance to the seawalls. The extent of parkland mitigation in areas affecting the seawalls is the same for all alternatives including Scheme Z.

Measures To Minimize Harm. Potential adverse effects will be mitigated through participation of the historical agencies in the location of required water features and park design, and through review of the design and construction specifications by the Project Conservator. Reconstruction of the granite seawalls will be accomplished in a manner similar to that prescribed in the 1984 MOA for seawalls affected by Project construction at Fort Point Channel. Repairs to adjacent seawall will also be explored as measures to minimize harm to the 4(f) resource.

Conclusion. Based on the above, there is no feasible and prudent alternative to the use of portions of the granite seawalls in the Charles River Basin Extension. The Preferred Alternative includes all possible planning to minimize harm to this resource.

4.4 REGISTRY OF MOTOR VEHICLES BUILDING

Scheme Z And New Design Alternatives. Scheme Z does not affect this resource. The Preferred Alternative and other new alternatives have a southbound land-based tunnel from Storrow Drive to the Central Artery and the Callahan Tunnel which passes under the building.

Description Of The Section 4(f) Property. The Registry building is an eight-story public office building designed by Edward P. Graham and built in 1932. The building, clad with cast stone with aluminum spandrels, is a significant example of Depression-era public architecture. It has been determined by MHC to be eligible based on its distinctive design and detailing characteristic of that period. While the building is structurally sound, the attachment system for its stone cladding has deteriorated leading to the loosening of facade panels, and substantial interior renovations are needed. The building is currently owned by the Massachusetts Division of Capital Planning and Operations (DCPO), which has noted in comments on the DSEIS/R that the building requires numerous costly interior and exterior repairs. DCPO has discussed with MHC and MHD the possibility that the building may be demolished for economic reasons.

Impacts On The Section 4(f) Property. Scheme Z was determined to require no long-term use or short-term impacts on the building. In all new alternatives, the tunnel leading from Storrow Drive to I-93 southbound passes directly under this building, requiring permanent subsurface use of the building and underpinning during construction. The extent of impact is essentially equal in the three alternatives and can be fully mitigated as described below. In addition, an at-grade roadway leading to Nashua Street (Ramp N-L) passes within 20 feet of and parallel to the entire length of the rear of the building, and has some effect on the visual setting of the building, but this visual impact is not of a magnitude to substantially impair the values and attributes of this building.

In the Preferred Alternative and the other alternatives to Scheme Z, the tunnel from Storrow Drive to the Central Artery passes under the building, requiring its underpinning. Preliminary engineering studies indicate that underpinning is structurally feasible and can be accomplished with a minimum of disruption to the building and its occupants. Some structural underpinning members will permanently occupy space within the basement of the building.

In Alternative 8.1D Mod 5, there is an above-ground ventilation building with eight exhaust air discharge stacks, located across Nashua Street on the Spaulding Hospital site, 230 feet away (see Chapter 2 for a discussion of ventilation building location and configuration). The presence of this structure does not significantly affect the setting of the Registry building, which has from the beginning been surrounded by a variety of scales and types of structures, including the Storrow Drive connector viaduct and adjacent BTEC Minot Station steam generating plant. (In the Draft Section 4(f) Evaluation it was reported that design refinements to Alternative 8.1D Mod 5 then under consideration included a ramp from Nashua Street with a boat section in the current location of the Registry building requiring the demolition of this 4(f) resource. These refinements were found not to meet design objectives and were dropped from further consideration.)

In the Reduced River-Tunnel Alternative there is a below-grade ventilation structure with four exhaust air discharge stacks, located across Nashua Street 230 feet to the east. As refined to avoid Section 4(f) parkland (see Sections 3.3 and 3.4 above) the Reduced River-Tunnel requires both the Storrow to Central Artery tunnel common to the other new alternatives and a second underpinning, at the Registry building's southwest corner. Both underpinnings could be accomplished in the same manner, with no long-term damage to the building. The ventilation building is much larger and above ground, similar to Alternative 8.1D Mod 5.

In the Preferred Alternative, there is a below-grade structure with four exhaust-air discharge stacks, located diagonally across Nashua Street 180 feet to the east. As discussed in the preceding paragraph, these structures do not significantly affect the visual setting of this building.

Avoidance Alternatives. There is no alternative which avoids all use of historic resources. Scheme Z avoids the Registry building, but uses another Section 4(f) historic resource, railroad signal Tower A, as well as having substantial visual impact on four of the five Section 4(f) parkland parcels; (these impacts are described in the other section of this Section 4(f) Evaluation). Extensive engineering studies for the new alternatives beginning prior to the 1991 FSEIS/R and continuing up to the current document have been unsuccessful in avoiding the tunnel alignment which pass under the Registry building.

As the connection between Storrow Drive and the Central Artery and Callahan Tunnel is necessary to meet the Project purpose, it is not possible to avoid the building in any alternative which utilizes land-based tunnels south of the Charles River to make this connection.

Measures To Minimize Harm. Assuming that the Registry building is still extant at the time of highway construction, in the Preferred Alternative, the building is underpinned by placing transverse beams in the basement of the building which transfer the foundation loads to new caissons, also to be constructed from within the building basement. This underpinning method would not require discontinuation of building use during construction. In addition, portions of the building's facade attachment system, which is deteriorated and allowing the facade cladding to become detached from the building, will be stabilized during the construction process as necessary, or replaced. These operations, as well as construction effects such as dewatering and vibration, will be managed and mitigated through review of design and construction specifications by the Project Conservator. Construction documents for the stabilization or reattachment of the building's facade will be prepared in consultation with MHC and reviewed by the Conservator. These measures will fully mitigate the impacts to the building.

MHD remains committed to underpinning and retaining the Registry building unless the building owners, with proper approval, wish to remove the building during Project construction. If removal is desired, MHD will cooperate with the building owners to remove the building. In any case, if the proper approvals to remove the buildings are obtained, the Project will not compromise the development potential of the Registry site and the adjacent Lomasney Way parcel.

Conclusion. Based on the above, there is no feasible and prudent alternative to the use of the Registry building which does not use other Section 4(f) historic resources. The Preferred Alternative uses the Registry building by constructing a tunnel underneath it and underpinning the building. The Preferred Alternative includes all possible planning to minimize harm to this property resulting from such use and will fully offset the impact.

4.5 HISTORIC RESOURCES NOT USED BY SCHEME Z OR NEW DESIGN ALTERNATIVES

4.5.1 Causeway/North Washington Streets Historic District

In the 1991 Section 4(f) Evaluation, Scheme Z was determined not to use or constructively use areas within this district, although there is traffic impact due to increased volumes on North Washington Street, owing to lack of a downtown northbound on-ramp, and the district's setting would be affected by the Scheme Z's Charles River bridges.

The Preferred Alternative and other new alternatives use no portion of the district, and all enhance its setting by reducing traffic volumes on North Washington Street and by substituting improved bridge designs. Measures to minimize harm to parklands, including improvements to Lovejoy Wharf and the area between the Charles River and Stop and Shop buildings and the I-93 boat section, would also benefit the district.

4.5.2 North End Historic District

Scheme Z And New Design Alternatives. Scheme Z removes the existing six-lane Central Artery viaduct which has noise and visual impacts on this district, replacing it with an eight-lane tunnel and also depressing connections between the Central Artery and the Callahan/Sumner Tunnels. Three boat sections are located at New Sudbury Street outside the district, approximately 90 feet away from the closest contributing structures in the district, five row houses at Stillman Place. A three-lane surface artery forms an intersection with Stillman Place and is located 35 feet from the closest row house.

The Preferred Alternative and other new alternatives are similar to Scheme Z in the vicinity of the district, but all have a modified design at New Sudbury Street which introduces an additional boat section. This boat section is located 40 feet from the Stillman Place row houses and is necessary to reincorporate the northbound downtown on-ramp which was deleted from Scheme Z between the 1990 DSEIS/R and the 1991 FSEIS. This change, while reducing traffic along the edge of the North End district, also causes a two-lane Surface Artery to be located approximately 27 feet closer to the district than in Scheme Z, or 8 feet from the corner of the nearest row house at Stillman Place.

Description Of The Section 4(f) Property. One of Boston's oldest residential neighborhoods, the North End is a densely built and visually cohesive neighborhood, first settled in the 1630s and heavily developed through the early twentieth century. Stillman Place is a narrow street with historic paving materials and five historic, Federal-period row houses (2-6 Stillman Place) facing a parking lot and the existing Central Artery viaduct, 20 to 65 feet away. The row house units, together with the historic pavement and bollards along Stillman Place, are contributing structures in the district.

Impacts On The Section 4(f) Property. Scheme Z does not use any part of the district and has a long-term benefit on its setting by removing the existing Central Artery viaduct which borders it. The absence of a downtown northbound on-ramp in Scheme Z results in heavier traffic volumes on the Surface Artery and North Washington Street, affecting contributing structures along the edge of the district.

Neither the Preferred Alternative nor the other new alternatives permanently uses any portion of the district. All new alternatives have the potential to displace temporarily up to 300 square feet of historic paving materials (granite pavers and granite bollards at the curb line) during construction of a new intersection of the Surface Artery with Stillman Place. This construction period impact is of limited extent and brief duration during the construction phase involving surface street construction. As in Scheme Z, the outer slurry wall of the Central Artery northbound tunnel passes within 10 to 15 feet of the row houses at 2-6 Stillman Place. Slurry wall construction was selected as a technique to minimize or avoid structural damage to historic buildings along the Central Artery and does not damage the Stillman Place row houses or other contributing features of the district.

In the new alternatives, the Surface Artery is reduced from three to two lanes in this area, but located closer to the edge of the district. This new city street passes within 8 feet from the corner of the closest of the historic row houses and 40 feet from the farthest row house unit. Daily traffic would be at least 15 percent lower on the Surface Artery in the new alternatives compared to Scheme Z and PM peak hour traffic at least 30 percent lower. These reductions in traffic benefits the North End District as a whole. The proximity of the new surface road to the Stillman Place row houses has an adverse effect on their visual setting, but is a substantial improvement over the existing setting of these urban row houses, which currently face the elevated Central Artery and a surface parking lot. This impact is not so severe as to substantially impair the resource.

Because the temporary use of historic paving materials is brief and of limited extent, and because the changes in setting do not substantially impair the Stillman Place row houses, no use or constructive use of district occurs.

Avoidance Alternatives. As discussed above, no use of the district occurs in any alternative.

Measures To Minimize Harm. The Preferred Alternative has an overall long-term positive effect on the district as a whole and on Stillman Place, by removing the existing Central Artery viaduct and thereby enhancing the district's setting. The Preferred Alternative reduces the proximity impacts of traffic on the district as a whole compared to Scheme Z. During further design refinement of the northbound on-ramp at New Sudbury Street, MHD will attempt to increase the distance between the Surface Artery and Stillman Place. Landscaping will be used to mitigate effects on the historic paving materials and the row house units. Surface Artery joint development guidelines for this area will contain preservation criteria to enhance the character and integrity of the district. Construction effects such as dewatering and vibration will be mitigated through review of design and construction specifications by the Project Conservator, as for other historic buildings along the alignment. The disturbance to historic paving materials at Stillman Place will be minimized, and any materials removed will be stored and replaced in the existing condition.

4.5.3 Charles River Railroad Draw 1

This railroad bridge is one of the last remaining Scherzer rolling lift bridges in the state. It is regularly used and is controlled from Tower A, which is described above.

Neither Scheme Z nor the new alternatives has any effect on this resource, which is significant only for its engineering design. In particular, because of adequate distances from Project elements, there is no effect due to the river tunnels in Alternative 8.1D Mod 5 or the Reduced River-Tunnel Alternative, nor from the Storrow Drive connector bridge in the Preferred Alternative.

4.5.4 Town Hill Historic District

This district, adjacent to City Square, contains residences and civic buildings significant to the history of development of Charlestown. There is no use or constructive use by Scheme Z, which is located more than 600 feet outside the district. In the Preferred Alternative and other new alternatives, there is also no use or constructive use, as the I-93 viaduct and connecting ramps will be lower, fewer in number, and farther from the district. A tunnel element in Alternative 8.1D Mod 5 is sufficiently removed from the district (approximately 200 feet) to require no temporary use during construction.

4.6 OVERALL COMPARISON OF HISTORIC RESOURCE IMPACTS AND CONCLUSION

Table 2 summarizes impacts on Section 4(f) historic resources. The new alternatives are similar in that they all have a tunnel under the Registry building, which results in a use that can be fully mitigated by underpinning the building and stabilizing the building's facade. The new alternatives also require a short opening in the granite seawall to provide a mandated water feature for wetlands/waterways mitigation. Permanent use of Tower A by overhead ramps and surrounding highway structure, as occurs in Scheme Z, is avoided. As the impacts of the new alternatives do not involve loss of a resource and can be well mitigated, and Scheme Z involves the loss of Tower A, there is an overall reduction in impact compared to Scheme Z. Therefore, the Preferred Alternative minimizes harm to 4(f) historic resources compared to Scheme Z.

MHC and the local historic agencies have been consulted regarding these impacts, as evidenced in the MHC letter, dated January 21, 1994, which is appended.

Differences among the new alternatives are small, with the Preferred Alternative having slightly lesser impacts. While the Preferred Alternative avoids Tower A altogether, Alternative 8.1D Mod 5 requires its underpinning. The only difference affecting historic resources between the Preferred Alternative and the original Reduced River-Tunnel Alternative is the latter's additional temporary impact to a portion of granite seawall, while the refined version of the Reduced River-Tunnel Alternative, which was studied during the preparation of the FSEIS/R, also has a second tunnel under the Registry building, requiring two separate underpinnings as compared to one underpinning in the Preferred Alternative.

Therefore, based upon the analysis presented in this Section 4(f) Evaluation, the Preferred Alternative minimizes harm to Section 4(f) historic resources compared both to Scheme Z and to the other new alternatives.

5 OVERALL CONCLUSION

The Preferred Alternative is compared to Scheme Z and to the other new alternatives for parkland impacts in Section 3.8 and for historic resource impacts in Section 4.6 of this Evaluation.

The parkland comparison refers both to the MHD's analysis and to the views of the MDC as expressed in its comments to MHD, which are appended. With respect to parkland impacts, the differences among the Preferred Alternative and the other new alternatives are small compared to their differences from Scheme Z. The Preferred Alternative minimizes harm compared to Scheme Z by substantially reducing proximity impacts and by facilitating park development consistent with the MDC master plan, as well as expanding Paul Revere Landing Park to a greater extent than Scheme Z. As compared to the other new alternatives, the Preferred Alternative is functionally equivalent in supporting MDC park objectives, and minimally different or essentially the same in its proximity impacts from the vantage point of a park user in the parks upstream of the railroad crossing. The Preferred Alternative also essentially equals or exceeds these other new alternatives in its overall expansion of Paul Revere Landing Park. The Preferred Alternative reduces harm to 4(f) parkland resources by avoiding substantial disruption to the upstream parks that would result during construction of the Reduced River-Tunnel Alternative and Alternative 8.1D Mod 5, as well as Alternative 8.1D Mod 5's greater traffic congestion next to the Esplanade. The refined version of the Reduced River-Tunnel Alternative avoids these additional impacts and is essentially the same as the Preferred Alternative; it does not, however, expand Paul Revere Landing Park North as much as the Preferred Alternative, nor does it reduce harm to parklands to a greater degree.

Therefore, based on these considerations, on balance the Preferred Alternative, while substantially similar to the other new alternatives, minimizes overall harm to 4(f) parkland resources.

With respect to historic resource impacts, the Preferred Alternative (and the Reduced River-Tunnel Alternative) avoid Tower A, while Scheme Z permanently uses Tower A by enveloping it in highway structures. Alternative 8.1D Mod 5 requires its underpinning. The Preferred Alternative and other new alternatives have tunnels under the Registry building, which can be successfully underpinned and fully mitigated. The new alternatives also require a short opening in the granite seawall in the North Point area to accommodate a mandated water feature for wetlands/waterways mitigation. When balanced against the loss of Tower A in Scheme Z, the impacts of the Preferred Alternative to the Registry building, which can be fully mitigated, and to a small portion of seawall, which can be at least partially mitigated, support a conclusion that there is less harm overall to historic resources in the Preferred Alternative and other new alternatives. The Preferred Alternative further reduces harm compared to the other new alternatives in that both the river-tunnel alternatives (including the refined version of the Reduced-River Tunnel) have additional temporary impacts to the granite seawall; Alternative 8.1D Mod 5 also requires underpinning of Tower A; and the refined version of the Reduced River-Tunnel Alternative requires a second underpinning of the Registry building. Therefore, the Preferred Alternative minimizes harm overall to 4(f) historic resources.

In summary, considering both parkland and historic resources, the Preferred Alternative is a substantial improvement over Scheme Z in reducing harm to parklands, and, with the mitigation measures agreed upon in the 1993 MOA, in achieving the MDC's park objectives for this area; and the Preferred Alternative also has slightly lesser impacts to historic resources than Scheme Z. As such, the Preferred Alternative minimizes harm to Section 4(f) resources overall as compared to Scheme Z. The Preferred Alternative is similar to the other new alternatives with regard to parkland impacts, but when all impacts are balanced, it minimizes harm relative to the other new alternatives. The small differences among the new alternatives as regards historic impacts favor the Preferred Alternative. Therefore, the Preferred Alternative is the alternative which best minimizes overall harm to Section 4(f) resources. The Preferred Alternative, together with the mitigation described in this Evaluation for parkland and for each affected historic resource, includes all possible planning to minimize harm.

TABLE 1. SUMMARY OF SECTION 4(f) PARKLAND IMPACTS

Scheme Z	Preferred Alternative (Non River Tunnel)	8.1D Mod 5	Reduced River Tunnel*
Storrow Drive/Lev Circle/Esplanade			
-Reconfigures Storrow/Leverett Circle	-Reconfigures Storrow/Leverett Circle	-Reconfigures Leverett Circle only	-Reconfigures Storrow/Leverett Circle
Nashua St. Park, GSA parcel, Charles River Recreation Area			
-Adverse visual/noise impacts on 3 upstream parks	-Greatly reduced visual impact and reduced noise on upstream parks.	-Greatly reduced visual impact and reduced noise on upstream parks.	-Greatly reduced visual impact and reduced noise on upstream parks.
-No construction impact	-No construction impact	-Major construction impact on 3 upstream parks, delays Nashua Street, permanent subsurface easement	-*Major construction impact, permanent subsurface easement*/No construction impact*
Paul Revere Landing Park (PRP)			
-Uses land in Paul Revere South; expands Paul Revere North; visual impact. Net increase 1.89 acre. Visual impacts.	-Uses land in Paul Revere South; adequate parkland remains for landscaped plaza and park entrance consistent with MDC master plan. Expands Paul Revere North by largest amount; removes adjacent ramp. Net increase 3.45 acre overall. Improved visual setting.	-Uses least area in Paul Revere South; adequate parkland remains for landscaped plaza and park entrance consistent with MDC master plan. Expands Paul Revere North by smaller amount than Preferred; removes adjacent ramp. Net increase 3.66 acre overall. Improved visual setting.	-Uses same area in Paul Revere South as Preferred; adequate parkland remains for landscaped plaza and park entrance consistent with MDC master plan. Expands Paul Revere North by same amount; removes adjacent ramp. Net increase 3.45 acre overall *(original version 2.75 acre).* Improved visual setting.
Park overall: continuous pedestrian access			
Constricted by loop ramps near/over riverbank	-Adequate width for pedestrian access between 4f parcels along entire north bank.	-Adequate width for pedestrian access between 4f parcels along entire north bank.	-Adequate width for pedestrian access between 4f parcels along entire north bank.
Park overall: usable parcels for recreation			
-All major parcels of usable size.	-All major parcels of usable size.	-All major parcels of usable size.	-All major parcels of usable size.
Park overall: views of river			
-Major structures interfere with views of river.	-Views greatly improved by reduced structure, improved bridge aesthetics	-Views greatly improved by reduced structure, improved bridge aesthetics.	-Views greatly improved by reduced structure, improved bridge aesthetics.
Key differences from Preferred Alternative	**Preferred Alternative**	**Key differences from Preferred Alternative**	**Key differences from Preferred Alternative**
-Visual and noise impacts on all parcels. Views and pedestrian continuity adversely affected by double-deck bridge. Ramps tangent to north bank of river with impact on continuous pedestrian access.	-Substantial improvement in pedestrian corridor along north bank and in visual setting contributing value to the park. Loop ramps reduced in number and height, adequate distance from river for continuous pedestrian access; Storrow connector bridge is single-deck.	-Similar visual impacts and pedestrian facilities. No background views of second bridge in transportation corridor, single loop ramp vs double loop ramp. North bank marginally wider.	-Similar visual impacts and pedestrian facilities. No background views of second bridge in transportation corridor, but mainline bridge wider.
-PRP north expanded less, PRP south similar in size, both portions affected by views of bridge structure.	-PRP north substantially expanded; PRP south similar size as Z.	-PRP north similar; PRP south slightly larger; visual setting of PRP similar.	-PRP north and south identical. *(PRP north expanded less.)* Visual setting of PRP identical.
		-Major temporary impacts on upstream parks. -Traffic congestion at Lev Circ. next to Esplanade.	-*Major temporary impact on upstream parks**

* *Italicized items apply to original Reduced River Tunnel Alternative as analyzed in DSEIS*; non-italicized items describe refined version or aspects common to both versions.

Source: B/PB

TABLE 2. SUMMARY OF SECTION 4(f) HISTORIC IMPACTS

Scheme Z	Preferred Alternative (Non River Tunnel)	8.1D Mod 5	Reduced River Tunnel*
Charles River Basin Historic District			
-No effect on contributing features	-No effect on contributing features	-No effect on contributing features	-No effect on contributing features
Railroad Signal Tower "A"			
-Permanent use due to ramps completely covering building 2-4 feet above roof and structures blocking sight lines to railroad tracks.	-No effect on resource.	-Underpinning required; no other permanent effect on resource.	-No effect on resource.
Granite Seawalls in the Charles River Basin Extension			
-Temporary impact at bridge piers.	-Temporary impact at bridge piers. -Permanent impact to 50' section at North Point due to water feature required for wetlands mitigation.	-Temporary impact at bridge piers, plus 250 foot section of wall at North Point reconstructed for tunnel crossing. -Permanent impact to 50' section at North Point due to water feature required for wetlands mitigation.	-Temporary impact at bridge piers, plus 100 foot section of wall on south bank reconstructed for tunnel crossing. *(Unrefined version instead temporarily affects 150' section at North Point.)* -Permanent impact to 50' section at North Point due to water feature required for wetlands mitigation.
Registry of Motor Vehicles Building (100 Nashua Street)			
-No effect.	-Underpinning required.	-Underpinning required.	-Underpinning required in two places; *(original version requires only single underpinning.)*
North End Historic District (Stillman Place)			
-Short-term temporary impact due to tunnel construction nearby.	-Short-term temporary impact due to tunnel construction nearby and temporary removal and replacement of 300 s.f. of historic paving materials.	-Short-term temporary impact due to tunnel construction nearby and temporary removal and replacement of 300 s.f. of historic paving materials.	-Short-term temporary impact due to tunnel construction nearby and temporary removal and replacement of 300 s.f. of historic paving materials.
Key differences from Preferred Alternative	**Preferred Alternative**	**Key differences from Preferred Alternative**	**Key differences from Preferred Alternative**
-Constructive use of Tower A. -Identical impact on granite seawalls -No impact of Registry Building. -Similar temporary impact on Stillman Place.	-No impact on Tower A. -Temporary impact on seawalls for bridge construction -Permanent impact on approx. 50' of granite seawalls -Registry Bldg. underpinning (fully mitigated) -Temporary effect on Stillman Place (fully mitigated)	-Tower A underpinning. -Temporary impact on seawalls for bridge and tunnel construction -Identical permanent impact on granite seawalls -Registry Bldg. underpinning (fully mitigated) -Temporary effect on Stillman Place (fully mitigated)	-No impact on Tower A as in Preferred. -Temporary impact on seawalls for bridge and tunnel construction -Identical permanent impact on granite seawalls -Registry Bldg. two underpinnings (fully mitigated) -Temporary effect on Stillman Place (fully mitigated)

* *Italicized items apply to original Reduced River Tunnel Alternative as analyzed in DSEIS*; non-italicized items describe refined version or aspects common to both versions.

Source: B/PB

APPENDIX TO FINAL SECTION 4(f) EVALUATION

- Letter from Metropolitan District Commission, December 30, 1993, regarding mitigation program
- Letter from Massachusetts Historical Commission, December 9, 1993, regarding archaeological reconnaissance survey
- Amendment and Restatement of Memorandum of Agreement among EOTC, MDC, and MHD, December 30, 1993, regarding mitigation program for New Charles River Basin
- Letter from Massachusetts Historical Commission, January 21, 1994, regarding consultation

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BECHTEL/PARSONS BRINCKERHOFF

December 9, 1993

Peter Zuk
Massachusetts Highway Department
1 South Station
Boston, MA 02110

RE: Archaeological Reconnaissance Survey of Project Alternatives, Area North of Causeway Street, Central Artery/Tunnel, Boston

Dear Mr. Zuk:

Thank you for submitting a copy of the draft report entitled "Addendum to Permit Application for Archaeological Reconnaissance Survey of Central Artery/Tunnel Area North of Causeway" which was prepared by Timelines, Inc. I have reviewed Timelines' draft report as well as their research design and methodology report and have the following comments.

Summaries of the research results should be included in the project EIS. The MHC looks forward to further consultation with MHC and FHWA concerning the preferred alternative. Prior to this consultation, it would be helpful if the archaeological reconnaissance of the preferred alternative would include graphic overlays of current conditions (existing utilities, landfills, etc.) and land use history such as those completed during the Phase I survey that was completed for the Central Artery in 1989 by Elia and Seasholes. This will insure consistency in the conduct of the research throughout the entire and will provide the MHC with adequate documentation to determine the need for archaeological field investigations for the preferred alternative.

In addition, I have reviewed the Chapter 91 Public Notice (#W93-2545) concerning the water main which is proposed to be installed between the CANA project area across the Charles River to Cambridge and the Museum of Science. Please submit an archaeological impact assessment for the proposed 2,200 foot long water main.

These comments are offered to assist in compliance with the stipulation of the project MOA under Section 106 of the National Historic Preservation Act. If you have any questions, please feel free to contact me.

Sincerely,

Brona Simon

Brona Simon
State Archaeologist
Deputy State Historic Preservation Officer

xc: Alex Almeida, FHWA
David Harrison, MHD
Elena Decima, Timelines
Boston Landmarks Commission
Cambridge Historical Commission

BS:HL

Massachusetts Historical Commission
80 Boylston Street, Boston, Massachusetts 02116 (617) 727-8470
Office of the Secretary of State, Michael J. Connolly, *Secretary*

The Commonwealth of Massachusetts
Metropolitan District Commission
M. Ilyas Bhatti, Commissioner

Office of the Commissioner
20 Somerset Street
Boston, MA 02108
617-727-5114
Fax 617-727-0891

December 30, 1993

Peter M. Zuk
Project Director
Central Artery/Tunnel Project
One South Station
Boston, MA

Re: Central Artery/Tunnel Charles River Crossing
Section 4(f) Evaluation and Park Mitigation

Dear Mr. Zuk:

Attached please find the "Amendment and Restatement of the Memorandum of Agreement" (MOA) among the Executive Office of Transportation (EOTC), the Massachusetts Highway Department (MHD), and the Metropolitan District Commission (MDC), which I have reviewed and approved for presentation to the Commission.

The MOA outlines a comprehensive mitigation plan for park, wetlands and waterways in the Area North of Causeway Street in conjunction with the forthcoming Final Supplemental Environmental Impact Statement/Report (FSEIS/R) for the New Charles River Basin Crossing. The Mitigation Measures set forth in the MOA have been the subject of extensive coordination between the EOEA, the EOTC and CA/T, DEP and MDC staff in recent weeks. The MDC wishes to recognize the efforts of all parties involved in addressing and resolving key issues in the Mitigation Measures associated with MHD's Preferred Alternative for the Crossing (the Non-River Tunnel Alternative, as refined).

Since the 1991 FSEIS/R there have been no changed circumstances that would necessitate any alteration in park designation in the New Charles River Basin portion of the MDC's Charles River Reservation, as outlined in my letter to Anthony Fusco of the Federal Highway Administration dated November 9, 1990.

The MDC agrees with MHD's assessment in the draft Section 4(f) Evaluation that the Preferred Alternative is a substantial improvement over the previously-adopted Scheme Z. As we noted in our comments on the DSEIS/R, the Preferred Alternative (like the other new alternatives studied in the FSEIS/R process) reduces proximity and visual impacts on current and future Charles River park and pedestrian access areas by improving bridge aesthetics, reducing the height and number of loop ramps north of the river, and moving the loop ramps further away from the river. The Preferred Alternative, in conjunction with the

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Mitigation Measures, adequately mitigates the impacts of the New Charles River Crossing on the New Charles River Basin portion of the Charles River Reservation.

Nevertheless, it has always been the MDC's view that the Preferred Alternative has impact on park areas which require substantial mitigation. The MHD's commitments, as set forth in the MOA, will assist in the achievement of MDC's longstanding vision of continuous park and pedestrian access connecting the Charles River Esplanade to Boston Harbor on both sides of the river. The MOA provides the vehicle for implementing the Mitigation Measures (as listed therein) which adequately and appropriately address the impacts of the New Charles River Crossing and achieve the following key park objections for development of this portion of the Charles River Reservation:

1. Implementation of the MOA will create continuous pedestrian and bicycle access along both sides of the river.

2. Implementation of the MOA includes development of four major park areas within the New Charles River Basin of sufficient size to support recreation. Paul Revere Landing Park North will be expanded to a greater extent than previously committed. Paul Revere Landing Park South, although impacted by the Preferred Alternative, can be successfully developed as a landscaped plaza for recreation uses. It will provide a suitable entry to the New Charles River Basin and provide a connection to Lovejoy Wharf at this key location. The Nashua Street park area will benefit from the additional acquisition of the waterfront portion of the Spaulding Hospital parcel. The park development of the former GSA parcel and additional land being acquired along the North Point waterfront will incorporate a significant new water feature, which will enhance active and passive recreational activities.

In addition, the MOA strikes a careful balance which meets MHD's needs for a level of certainty regarding the Mitigation Measure commitments, while providing MDC the flexibility to enhance the parkland resources as circumstances allow. The MOA also contains an appropriate funding commitment by MHD to a level of quality of park design which is fitting in the New Charles River Basin.

While the Preferred Alternative offers aesthetic improvements over Scheme Z, the MDC still requires that special attention be paid to the design and location of bridge piers and related structures, and the design of the area under the bridge, to assist in achieving MDC's park objectives.

Finally, we are pleased that the MHD recognizes the particular importance of implementing the Mitigation Measures, especially the Pre-mainline Measures, in a timely fashion.

We look forward to working with MHD to ensure the effective implementation of this significant Memorandum of Agreement.

Sincerely,

M. Ilyas Bhatti
Commissioner

AMENDMENT AND RESTATEMENT OF THE
MEMORANDUM OF AGREEMENT

AMONG

EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION

AND

MASSACHUSETTS HIGHWAY DEPARTMENT

(formerly the DEPARTMENT OF PUBLIC WORKS)

AND

METROPOLITAN DISTRICT COMMISSION

THIS AMENDMENT AND RESTATEMENT OF THE MEMORANDUM OF AGREEMENT (the **"MOA"**) by and among the **EXECUTIVE OFFICE OF TRANSPORTATION AND CONSTRUCTION,** established and existing under Chapter 6A of the General Laws of Massachusetts and having a principal place of business at 10 Park Plaza, Boston, MA 02116 (the **"EOTC"**), the **MASSACHUSETTS HIGHWAY DEPARTMENT (formerly the Department of Public Works),** established and existing under Chapter 16 of the General Laws of Massachusetts and having a principal place of business at 10 Park Plaza, Boston, MA 02116 (the **"MHD"**), and the **METROPOLITAN DISTRICT COMMISSION,** established and existing under Chapter 28 of the General Laws of Massachusetts and having a principal place of business at 20 Somerset Street, Boston, MA 02108 (the **"MDC"**) (hereinafter "the parties"), is made as of this 30th Day of December, 1993, by amending and restating the Memorandum of Agreement among the parties and the **EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS,** established and existing under Chapter 21A of the General Laws of Massachusetts and having a principal place of business at 100 Cambridge Street, Boston, MA 02202 (the **"EOEA"**),dated July 29, 1991 (the "Original MOA") in the following manner specified below. The parties recognize that EOEA, a signatory to the Original MOA, must review the FSEIS/R for the MHD's New Charles River Crossing design and that EOEA can not join in this MOA prior to the issuance of a MEPA Certificate on the FSEIS/R. Notwithstanding this fact, the EOTC, the MHD and the MDC agree to the content of this MOA and to be bound by the terms hereof. The Original MOA is therefore amended in the following manner:

The text of the Original MOA, beginning with the words "This Memorandum of Agreement" on page 1 and concluding with the words "permitted by Law" on page 18, is deleted and the following text is substituted in lieu thereof:

RECITALS

The EOTC, the MHD, and the MDC recognize and recite the following facts upon which the agreements herein are based:

1. The MDC, on behalf of the Commonwealth, owns (or will acquire) and manages the Charles River Basin, including the New Charles River Basin (as defined below), certain parklands adjacent to the Charles River, and the Charles River Dam with navigation locks. The New Charles River Basin is that area between and including the Charles River Dam and the former Charles River Dam (the "New Charles River Basin").

2. The MDC has had long-standing planning objectives of improving the Charles River Basin as part of the metropolitan park system. These objectives are delineated in a letter from M. Ilyas Bhatti, Commissioner, Metropolitan District Commission, to Mr. Anthony Fusco, Regional Administrator, Federal Highway Administration dated November 9, 1990 (a copy of which is attached hereto as Exhibit A).

3. The MHD is in the process of designing and constructing

the Central Artery/Tunnel Project (the "CA/T Project" or the "Project") in Boston, Massachusetts. As part of the CA/T Project, the MHD plans to depress and widen the Central Artery through downtown Boston to Charlestown and to construct a Seaport Access Highway through South Boston which will connect to a new tunnel under Boston Harbor to Logan Airport in East Boston. The Central Artery portion of the Project includes an improved connection between Interstate Route 93, Route 1 and the Central Artery. This improved connection requires the design and construction of a new crossing of the New Charles River Basin.

4. The MHD is preparing to file an FSEIS/R for the design of such a crossing, hereinafter referred to as the "New Charles River Crossing". The parties recognize that the New Charles River Crossing design represents a substantial improvement over Scheme Z, the former Proposed Action. The overall height and mass of the bridge and loop ramp structures have been reduced. The extent and quality of pedestrian access opportunities in the New Charles River Basin have also been improved.

5. The parties recognize that the New Charles River Crossing provides a unique opportunity to further the MDC's goal of developing the Charles River Reservation in the New Charles River Basin. Consequently, the MDC and the MHD have consulted and agreed on mitigation measures in the New Charles River Basin that would both mitigate the Project's impacts on the New Charles River Basin and advance the MDC's goal of developing the New Charles River Basin park and open space. Many of these measures were originally

set forth in a letter from William V. Twomey, Director, I-90/I-93 Project to M. Ilyas Bhatti, Commissioner, Metropolitan District Commission dated November 9, 1990 (the "Letter of Agreement").

6. The Certificate of the Secretary of Environmental Affairs on the CA/T Project's Final Supplemental Environmental Impact Report (the "FSEIR") dated January 2, 1991 (the 1991 "MEPA Certificate") approved the mitigation measures identified in the Letter of Agreement required to mitigate the environmental impacts of the Project.

7. Subsequent to the 1991 MEPA Certificate, the parties entered into the Original MOA which set forth certain agreements and undertakings among the parties. Since that time the MHD provided funds for the MDC to proceed with its master planning process (the "Master Planning Process"). The purpose of the Master Planning Process was to ensure that the planning and design of the various mitigation items created an integrated park and pedestrian environment for the area.

8. In light of the New Charles River Crossing design and the completion of the MDC Master Planning process, undertaken as described in the Letter of Agreement, the parties desire to set forth certain agreements and undertakings herein contained and amend and restate the Original MOA.

AGREEMENT

Now therefore, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the EOTC, the MHD and the MDC hereby agree as follows:

I. MASTER PLAN

A. Roles of the parties in the Master Planning Process

The MDC, with the assistance of its Master Planning Consultant (the "Consultant"), was funded by the MHD to conduct a master planning study and prepare a New Charles River Basin Master Plan (the "Master Plan") to develop an integrated park and pedestrian environment for the area. The parties acknowledge that the Consultant's tasks were set forth in a scope of services (the "Scope of Services") and agreed upon by the parties to the Original MOA.

The MDC has submitted the Master Plan to the EOEA for the EOEA's review. The MHD reviewed the Master Plan upon the completion of each phase as outlined in the Scope of Services for consistency with the Letter of Agreement and the MEPA Certificate and for any aspect of the Master Plan which would reasonably be expected to affect the design, construction and scheduling requirements of the CA/T Project. The MDC and the MHD shall ensure that the "Mitigation Measures" (the measures set forth in Item I.B.4) are implemented in a manner consistent with, to the greatest extent possible, the Master Plan for the New Charles River Basin.

B. Mitigation Measures and Performance Standards

1. Purpose of the Performance Standards

The list of Mitigation Measures includes a series of park improvements, pedestrian connections, and wetlands and waterways mitigation. All Mitigation Measures shall be implemented pursuant to applicable laws and regulations. The Performance Standards establish baseline criteria for implementing the list of Mitigation Measures. The MDC shall use its expertise and experience in parkland design and construction to develop at least the level of improvement described in the Performance Standards, in a manner designed to achieve the greatest possible consistency with the MDC Master Plan, but in no area shall the "Usable Area" be less than the area identified below. "Usable Area" shall mean areas generally accessible to the public for open space and recreational purposes, including pedestrian and bicycle paths. All acreages are approximate. Satisfaction of the Performance Standards requirements is not intended to require the placement of any fill in the Charles River below the ordinary high water level (103.3 CA/T Datum).

2. Performance Standards for Parkland and Accessibility

For each area intended for public use and enjoyment, the level of quality that is to be achieved shall be typical of other parks in the Charles River Reservation, such as Lechmere Canal, Front Park, and Kennedy Park, and the historic work of the original Storrow Memorial Embankment (the Esplanade). Pedestrian and bicycle access shall be continuous along both banks of the river, shall meet all applicable guidelines for accessibility, and shall provide for separation of pedestrians and bicycles where appropriate. Path widths shall be adequate for anticipated use, with a minimum width of 10-12 feet for principal paths. The term "Improve", as used herein, shall encompass site preparation, landscaping, ancillary utilities and structures, utility relocations, and all work necessary to address structural issues, including, without limitation, seawalls, banks, and decks.

3. Performance Standards for Wetlands and Water Feature

Wetlands and water features must be incorporated as part of the North Point Area, designated on the Master Plan as: "North Point West", "North Point East" and "North Point Wilds." The following Performance Standards must be met.

A. Vegetated Wetlands Features

1. Minimum 9,500 s.f. of vegetated wetlands (with appropriate plant species) located between elevations 101.0 and 103.5 (CA/T datum) of which 4,000 s.f. must be capable of being classified as "bordering vegetated wetland" under State Wetland Regulations and located between elevation 102.4 and 103.5. May be composed of two or more areas, but each area must have a minimum of 4,000 square feet.

2. Must be hydraulically connected to the Charles River.

3. The vegetated wetlands feature cannot be entirely shaded.

4. Portions must be located in Boston and Cambridge.

5. Soils must be of a suitable substrate for establishment of wetland vegetation.

B. Water Feature

1. Requires 1.2 acres of contiguous watersheet at elevation 102.4, in a manner which will provide 43,000 cubic feet of flood storage volume between elevation 103.5 and 104.3

2. Must be navigable by small watercraft and connect to the Charles River in at least two places.

3. Must have sufficient flow to prevent stagnation.

4. Must have sufficient depth to inhibit growth of vegetation on the bottom which would interfere with navigation.

5. Portions must be located in Boston and Cambridge.

4. List of Mitigation Measures

1. Paul Revere Landing Park South (the Master Plan designates this area as "Revere Plaza East and West").

   1.1 Improve park

   1.2 Improve corridor south to Causeway Street

   1.3 Connect riverside walkway to south trestle walkway

   1.4 Provide south bank railroad overpass for pedestrians/bicycles

DESCRIPTION:
Paul Revere Landing Park South and associated access along the Charles River and south to Causeway Street, with pedestrian overpass to the North portion of the Spaulding Rehabilitation Hospital site.

Minimum Area: 2.0 +/- acres

2. Lovejoy Wharf Park

   2.1 Acquire wharf property

2.2 Demolish existing timber wharf and timber piles

2.3 Reconstruct wharf

2.4 Improve as park with walkway

2.5 Provide Lovejoy Wharf/North End Park walkway underpass, with access to North Washington Street bridge

DESCRIPTION:
Lovejoy Wharf, including underpass and connection to North Washington Street Bridge sidewalk.

Minimum Area: 0.8 +/- acres.

3. Leverett Circle/Storrow Drive

3.1 Improve greenspaces and edges

3.2 Provide appropriate architectural treatment to underpass and boat section facade

3.3 Provide new pedestrian overpass between Leverett Circle/Science Park MBTA Station and Nashua Street Park

DESCRIPTION:
Minimum area is primarily related to sidewalks and pedestrian overpasses; remainder is parkway landscaped area.

Landscaped Area: 0.9 +/- acres.

4. Paul Revere Landing Park North (the Master Plan designates this area as "Charlestown Meadow East").

4.1 Improve park

4.2 Provide Tudor Wharf/Revere North walkway underpass

DESCRIPTION:
Paul Revere Landing Park North, including underpass to Tudor Wharf.

Minimum Area 4.6 +/- acres.

5. Revere Park North, Westerly Extension (the Master Plan designates this area as

"Charlestown Meadows West").

5.1 Construct walkway over MBTA railroad tracks to connect with North Point East Park

5.2 Improve park

5.3 Provide walkway from Rutherford Avenue to Charles River alongside Millers River

5.4 (Intentionally omitted)

5.5 Construct walkways on either side of MBTA bascule bridge, north half

DESCRIPTION:
North bank of the Charles River from Paul Revere Landing Park North to the MBTA railroad right of way, including the Millers River area and path connecting to Rutherford Avenue via the new intersection. Area extends from the river to the first at-grade/boat section highway ramp. Includes pedestrian overpass to North Point West and walkways along MBTA bascule bridge.

Minimum Area 6.0 +/- acres.

6. (Intentionally omitted)

7. Nashua Street Park (the Master Plan designates this area as "Nashua Meadows").

7.1 Improve park

7.2 Improve waterfront portion of Spaulding Rehabilitation Hospital site with minimum 100 foot depth (0.6 +/- acres).

7.3 Rehabilitate shoreline to permit park use.

7.4 Remove pilings from watersheet (subject to review of issue with owner).

DESCRIPTION:
Nashua Street parcel from O'Brien Highway to edge of MBTA railroad right of way (includes waterfront portion of Spaulding Rehabilitation Hospital site).

Minimum Area 2.6 acres (includes portion of Spaulding site).

8. North bank of the Charles River (the Master

Plan designates this area as "North Point East").

8.1 Acquire land

8.2 Improve park

8.3 Remove existing railroad trestle (subject to review of issue with owner)

8.4 Rehabilitate Shoreline to permit park use.

8.5 Remediate contaminated/hazardous soils, as necessary.

8.6 Provide new water feature, incorporating bordering vegetated wetlands.

DESCRIPTION:
From MBTA right of way to the boundary of the MDC Central Services parcel, and extending from the river to the proposed roadway in North Point and to the highway loop ramps.

Minimum Area 2.10 +/- acres.

9. North Point I (the Master Plan designates this area as "North Point West").

9.1 Acquire land for relocation of MDC Central Services facility

9.2 Replace MDC Central Services facility

9.3 Demolish existing MDC central services facility

9.4 Remediate contaminated/hazardous soils as necessary

9.5 Improve park

9.6 Provide new water feature, incorporating bordering vegetated wetlands

9.7 Provide pedestrian access to North Point Park and Historic Dam North and South

DESCRIPTION:
Banks of the river including MDC Central Services parcel extending to O’Brien Highway and the proposed roadway in North Point.

Minimum Area 2.9 +/- acres.

10. "Historic Dam South" as designated on Master Plan.

    10.1 Improve area and upgrade associated structures to extent practicable.

DESCRIPTION:
MDC property south of the historic lock extending from O'Brien Highway upstream to area where embankment widens.

Minimum Area 3.1 +/- acres.

11. Historic Dam North as designated on Master Plan

    11.1 Improve area and upgrade associated structures to extent practicable

DESCRIPTION:
MDC property accessible to the public outside of the Museum of Science including historic structures.

Minimum Area 1.6 +/- acres.

12. North Point II (the Master Plan designates this area as "North Point Wilds")

    12.1 Improve area

DESCRIPTION:
Area generally lying between the proposed roadway in North Point and the MBTA railroad right of way, and extending from the highway loop ramps north to the Gilmore Bridge.

Minimum Area: 6.3 +/- acres

The parties acknowledge and agree that development of the Mitigation Measures in accordance with the terms of this MOA constitutes adequate mitigation for the MDC's parkland requirements associated with the New Charles River Crossing, and that the use of well-designed Mitigation Measures to meet both parkland and wetlands/waterways mitigation requirements is desirable. The MDC agrees that, in its view, these measures are appropriate substitutions for the mitigation measures originally proposed for the Central Artery North Area Project (another MHD project located in the New Charles River Basin) as set forth in the license issued pursuant to M.G.L. Chapter 91 for the Central Artery North Area Project, License No. 1742.

The parties acknowledge and agree that the design process and public comment as required by licenses and permits may identify desirable changes to the above list. Therefore, the parties further acknowledge and agree that modifications may be made to the above list under the conditions set forth herein and upon the agreement of the MHD and the MDC, subject to regulatory approvals.

II. DESIGN AND CONSTRUCTION OF MITIGATION MEASURES

A. Phasing of Design and Construction

The parties acknowledge and agree that the design and construction of certain Mitigation Measures will be commenced expeditiously after the Master Planning Process, and upon issuance of required permits and approvals but no later than the initiation of CA/T Project construction in the New Charles River Basin (the "Pre-mainline Measures"). The parties further acknowledge and agree that they have reviewed and confirmed the Mitigation Measures listed above that can be built as Pre-mainline Measures, and have established priorities for the remaining Mitigation Measures so as to minimize the need for restoration after completion of the CA/T Project. In determining which of the Mitigation Measures shall be Pre-mainline Measures, the parties agree not to designate any

Mitigation Measure as a Pre-mainline Measure which, because of its location or other factors, is likely to be affected by construction activities on the CA/T Project. The parties acknowledge and agree that the Conceptual Implementation Schedule (attached hereto as Exhibit "B") for the Mitigation Measures is subject to modification by the MHD in consultation with the MDC as a result of CA/T Project design and scheduling refinements.

The following Mitigation Measures are now classified as Pre-mainline Measures:

- Lovejoy Wharf and walkways
- Nashua Street Parcel (except Spaulding portion)
- North Point (East and West)
- Paul Revere Landing North and walkways
- Historic Dam (North and South)

B. MDC Role for Design and Construction

The parties acknowledge and agree that the MDC shall be the party responsible for the design, construction, and permitting (the "Implementing Agency") of the Mitigation Measures that are located outside the CA/T Project limits as they are presented in the Project's FSEIS/R as generally depicted on the attached illustration ("Exhibit C"), (the "Project limits" are delineated on Exhibit B as areas 1(b), 5 and 12). The MDC shall be the "Implementing Agency" for Mitigation Measures outside the CA/T Project limits and the "Non-Implementing Agency" for Mitigation Measures within the CA/T Project limits. The parties further acknowledge and agree that such limits are subject to modification and that the MDC's and the MHD's responsibility for design and construction of the Mitigation Measures will be determined by such limits as are finally established.

For each Mitigation Measure for which the MDC is responsible, the MDC agrees to consult with the MHD at the planning, 25% design, 75% design, and 90% design stages to ensure consistency with the Mitigation Measures located either partially or entirely within the Project limits.

The MDC agrees to complete the design and construction of each Mitigation Measure for which it is responsible in compliance with all applicable laws and for any measure that affects CA/T work, in a manner that will facilitate CA/T Project construction in accordance with the CA/T Project’s master schedule. The MDC further agrees to provide standards for design and construction of MDC improvements to the MHD as necessary for the design and construction of Mitigation Measures for which the MHD is responsible.

C. MHD Role for Design and Construction

The parties agree that the MHD shall be responsible for the design and construction of the Mitigation Measures that are located inside the CA/T Project limits. The MHD shall be the Implementing Agency for Mitigation Measures within the CA/T Project Limits and the Non-Implementing Agency for Mitigation Measures outside CA/T Project limits.

For each Mitigation Measure for which the MHD is responsible, the MHD agrees to consult with the MDC at the planning, 25% design, 75% design, and 90% design stages. The MHD further agrees to use MDC design and construction standards, unless in the MHD's judgment such standards would conflict with highway design standards or regulations applicable to the CA/T Project, in designing and constructing the Mitigation Measures.

The MHD agrees to provide all CA/T Project right of way drawings and construction staging and sequencing drawings to the MDC as necessary for the design and construction of Mitigation Measures for which the MDC is responsible. The MHD further agrees to provide the CA/T Project's master schedule to the MDC.

The MHD agrees to fund the design and construction of the Mitigation Measures commensurate with the level of quality that is specified in the Performance Standards.

III. CONTROL AND MAINTENANCE OF MITIGATION MEASURES

The parties acknowledge and agree that the park and pedestrian improvements created by the Mitigation Measures shall be maintained and controlled by the MDC. Those Mitigation Measures which are integral to the operation of highway facilities shall be maintained by the MHD. Upon completion of the CA/T Project, the MHD agrees to transfer to the MDC, subject to MHD acquisition of the same, if necessary, and subject to applicable law, control of the land or interests in land necessary or desirable to achieve this intent. In its transfers, the MHD shall reserve rights in such land as necessary to maintain, repair and replace highway Project improvements.

The MDC further agrees, subject to applicable law, to fully cooperate with the MHD in any requests by the MHD for the transfer of any MDC land, rights in land and rights to use land as determined by MHD and agreed to by the MDC to be necessary or desirable for the construction of the Mitigation Measures or to construct, maintain, repair and replace other CA/T Project improvements and to cooperate with the MHD in connection with any legislation that may be necessary to facilitate such transfers.

IV. CITIZENS ADVISORY COMMITTEE

The EOEA has established a Citizen's Advisory Committee (CAC) comprised of seven representatives from the environmental and design communities appointed by the Secretary of Environmental Affairs, seven representatives appointed by the Mayor of the City of Boston, and seven representatives appointed by the Mayor of the City of Cambridge.

The parties agree that any of the representatives may be changed from time to time by the party originally designating such representative and that notice of such change be given to the parties to this MOA.

The parties acknowledge and agree that the role of the CAC shall be to advise and comment on the implementation of the Master Plan, and to serve as forum for public discussion on New Charles River Basin parkland issues. The MDC shall, in good faith, review the CAC's comments on the concepts and shall incorporate all such comments that the MDC determines to be reasonable and consistent with the goals of the Master Plan and with the MDC's role as stated herein. MHD and MDC shall co-ordinate MHD's input to and participation in CAC activities.

V. PERMITS

The parties acknowledge and agree that all Mitigation Measures contemplated by this MOA must be planned, designed and constructed in accordance with all applicable federal, state and local laws and regulations.

The MHD agrees to obtain any necessary permits, licenses and approvals for all Mitigation Measures for which the MHD is responsible for design and construction. The MDC agrees to obtain any necessary permits, licenses and approvals for all Mitigation Measures for which the MDC is responsible for design and construction.

The inability of either party to obtain a permit, license or other approval shall not relieve that party of its obligation to meet the Performance Standards for a Mitigation Measure. In the event that MDC elects to pursue shoreline adjustments or other parkland enhancement options not encompassed in the Performance Standards but consistent with the Master Plan, it agrees to assume the permitting requirements of such options, including any permit conditions requiring mitigation for the impacts of such options. Subject further to the terms set forth in Section VI.A hereof, MDC may, at its discretion, elect to adjust its park design criteria for the development of specific areas of the New Charles River Basin in order to facilitate any desired parkland enhancement options. The parties agree not to eliminate the implementation of any listed Mitigation Measure in accordance with the Performance Standards (unless implementation is technically infeasible from an engineering standpoint). The parties further agree to achieve the implementation of the Mitigation Measures substantially within the time frames set forth in the Conceptual Implementation Schedule (attached hereto as Exhibit B), and within the level of MHD funding specified in Section VI.A. herein. Since the timely implementation of the Mitigation Measures requires timely funding, MHD agrees to use its best efforts to secure and provide funding to the Implementing Agency in a manner which will facilitate the implementation of this MOA, in accordance with the Conceptual Implementation Schedule. MHD’s commitment to meet the level of funding for the Mitigation Measures shall not be affected by the MDC’s election to prioritize certain Mitigation Measures within the Mitigation program, provided that no Mitigation Measure is eliminated.

The MDC and the MHD agree that in the event that either is unable to obtain a necessary permit, license, and/or approval for any Mitigation Measure, it shall promptly notify the other party. The MDC and the MHD shall, in good faith, then attempt to resolve the issue to the satisfaction of the permitting agency. Upon failure to so resolve the issue, the MDC and the MHD shall, in good faith, seek to identify an equivalent Mitigation Measure. Upon the Implementing Agency’s successful acquisition of all necessary permits, licenses, and approvals for the alternative mitigation measure, and subject to concurrence of FHWA and EOEA, the MHD or the MDC, as appropriate, shall implement the alternative mitigation measure.

The MDC agrees to cooperate with the MHD to obtain any and all permits, licenses, and approvals needed to construct the Mitigation Measures that involve the jurisdiction of the MDC. The MHD agrees to cooperate with the MDC to obtain any and all permits, licenses and approvals needed to construct the Mitigation Measures that involve the jurisdiction of the MHD. The MHD and the MDC agree to seek all necessary permits, licenses, and approvals in a timely manner which will support CA/T Project construction in accordance with the CA/T Project's master schedule.

VI. FUNDING

A. Level of Funding

The parties have assessed the impacts of the New Charles River Crossing, and agree that implementation of the Mitigation Measures in a manner consistent with this MOA adequately and appropriately address these impacts. The parties further agree, after reviewing the fiscal requirements of the parkland, wetlands and waterways mitigation program, that implementation (design and construction) of the Mitigation Measures (in a manner consistent with the Performance Standards), can and shall be attained with an MHD funding program of eighty (80) million dollars in 1993 dollars.

Subject to the terms of this MOA, MHD agrees to secure and provide funding to the Implementing Agency to implement the Mitigation Measures and MDC and MHD agree to implement the Mitigation Measures in a manner which shall satisfy all of the Performance Standards. To the extent MDC seeks to implement a Mitigation Measure[s] which entails parkland enhancements beyond those specified in the Performance Standards it agrees to do so in a manner which will not preclude the successful implementation of all Performance Standards outlined in the Mitigation Measures and to assume responsibility for all funding requirements for such parkland enhancements to the extent they exceed the 80 million dollar funding program for the implementation of all the Mitigation Measures specified herein.

The ability of the MDC to implement the Mitigation Measures in a cost-effective manner shall not affect MHD's obligation to provide the funding set forth herein, and the MDC may use such funding available after implementation of all of the Performance Standards set forth herein for other parkland implementation as part of the mitigation for the New Charles River Crossing.

B. **Sources of Funding**

The parties acknowledge and agree that the FHWA is a co-proponent of the CA/T Project, and is the primary funding source for CA/T Project activities. The MHD agrees to use its best efforts to maximize Federal Highway Administration ("FHWA") participation in funding the Mitigation Measures. The MDC agrees to cooperate with the MHD to achieve such maximum FHWA participation. The parties agree that all CA/T Project construction activities, including implementation of the Mitigation Measures, not eligible for FHWA funding are subject to capital appropriation by the Legislature and authorization of annual capital spending limits by the Massachusetts Executive Office of Administration and Finance and that the implementation of CA/T

Project construction activities, including the Mitigation Measures, is subject to the availability of funding from federal or state sources as herein provided. The parties agree that implementation of the Mitigation Measures is an essential element of proceeding with the CA/T Project final design and construction activity in the Area North of Causeway Street ("ANOCS"). Therefore, any funding for CA/T Project design and construction activities in the ANOCS subarea shall also include funding sufficient to implement the Mitigation Measures according to the Conceptual Implementation Schedule.

C. Funding through Interagency Service Agreements

The MHD agrees to fund, through annual Interagency Service Agreements (the "ISAs") or other appropriate annual agreements, MDC staff and Consultant costs reasonably incurred related to design, programming, construction, and project management for Mitigation Measures for which the MDC is responsible. The MHD agrees to fund these costs at levels which are usual and customary. The MDC agrees to provide the MHD with a proposed overall budget for the Mitigation Measures in accordance with the "Level of Funding" provisions of this MOA as the MDC develops annual scopes of work as necessary to formulate ISAs. Proceeding with the implementation of a Mitigation Measure is subject to the review and acceptance of the cost estimate for that Mitigation Measure as well as the overall budget for the Mitigation Measures as a whole by the Non-Implementing Agency. In the event an issue regarding the total estimated cost of an individual

Mitigation Measure or the overall budget for implementing Mitigation Measures (arising either prior to implementation or upon completion of implementation) remains unresolved, MHD and MDC shall consult with the committee of representatives designated pursuant to Section VII.C of this MOA.

The parties acknowledge that the MDC, which as the regional park agency for metropolitan Boston has unique experience and special expertise in the management of urban park systems, assumed the lead role in the master planning of the Mitigation Measures. Accordingly, the MDC agrees that the personnel funded under this Agreement shall be qualified in the management of architectural and landscape design contracts, and that the performance of such personnel shall reflect the appropriate professional standards of care and practice.

The MHD further agrees to fund, through annual ISAs, or any other appropriate annual agreement the reasonable costs of design, programming, construction, and project management of Mitigation Measures based upon the implementation, cost estimate and phasing schedule done as part of the Master Plan and The Conceptual Implementation Schedule, in accordance with the terms of this Section.

VII. MISCELLANEOUS

A. Notices

Any and all notices or other communications required or permitted hereunder shall be in writing and delivered by hand, or mailed, postage prepaid, return receipt requested, by registered, certified or express mail, to the parties at the addresses set forth below or at such other addresses which are furnished from time to time in writing to the other parties. Any such notice shall be effective upon receipt, if delivered, or upon deposit with the U.S. Postal Service, if mailed.

The EOTC:

Secretary of Transportation
Executive Office of Transportation
and Construction
State Transportation Building
Ten Park Plaza
Boston, MA 02116

The EOEA:

Secretary of Environmental Affairs
Executive Office of Environmental
Affairs
100 Cambridge Street
Boston, MA 02202

The MHD:

Commissioner
Massachusetts Highway Department
State Transportation Building
Ten Park Plaza
Boston, Ma 02116

with copies to:

Project Director
Central Artery/Tunnel Project
One South Station
Boston, MA 02110

Chief Counsel
Central Artery/Tunnel Project
One South Station
Boston, MA 02110

The MDC:

Commissioner
Metropolitan District Commission
20 Somerset Street
Boston, MA 02108

with copies to:

Director of Planning
Metropolitan District Commission
20 Somerset Street
Boston, MA 02108

Chief Counsel
Metropolitan District Commission
20 Somerset Street
Boston, MA 02108

B. **Termination**

In the event that the parties are unable to fulfill their responsibilities hereunder as a result of (i) impossibility of performance or (ii) the inability to proceed with the CA/T Project as approved in the MEPA Certificate dated January 2, 1991, and the MEPA Certificate to be issued for the New Charles River Crossing FSEIS/R as such Certificates may be modified and confirmed through any subsequent environmental review procedures that may be required, the parties may, at their option, terminate this MOA by forwarding to the other parties written notice, in which case this Agreement shall terminate and be of no further force or effect immediately upon such notice. The written notice shall describe the contingency which gives rise to the notice of termination.

C. **Representation**

EOTC, EOEA, MHD, and MDC shall, from time to time, each designate in writing individuals to act as its representatives for coordination of matters in connection with this MOA. EOTC hereby initially designates its General Counsel and Deputy Secretary of Environmental Policy as its representatives, EOEA hereby initially designates its General Counsel and Undersecretary as its representative, MHD hereby initially designates its CA/T Chief Counsel and CA/T Manager of Environmental Planning as its representatives, MDC hereby initially designates its General

Counsel and Director of Planning as its representatives. Each of EOTC, EOEA, MHD, and MDC shall make its responsibilities under this MOA a high priority for the individuals acting as its representatives and shall maintain continuity of communication by giving each other as much advance written notice as is possible under the circumstances, in the event of a change in representation. Each of EOTC, EOEA, MHD, and MDC shall use reasonable efforts to assure that its representatives under this MOA (or a designee, as appropriate) are available should a need arise. The representatives (or their designees) shall meet as requested to resolve any issues arising hereunder including, without limitation, issues of funding, scheduling and permitting.

D. Work in Harmony

The MHD and the MDC agree to provide competent, suitably qualified and reliable personnel to perform the planning, design and construction of the Mitigation Measures contemplated by this MOA. The MHD and the MDC further agree to at all times maintain good discipline and order at the construction site(s). The MHD and the MDC shall furnish labor that can work in harmony with all other elements of labor employed or to be employed on CA/T Project work.

E. Applicable Law; Successors and Assigns

This MOA is intended to be a binding agreement, enforceable as such, which shall be interpreted pursuant to the laws of the Commonwealth of Massachusetts and shall be construed as a contract under seal. The rights, obligations, liabilities, terms, conditions and agreements hereof shall inure to the benefit of and be binding upon the successors, assigns, representatives and transferee of the parties and all other person claiming by or through the parties.

F. Amendment

This MOA, or any part thereof, may be amended from time to time hereafter only in writing executed by the parties to the MOA at the time of the amendment. Upon the issuance of a MEPA Certificate on the New Charles River Crossing FSEIS/R, the parties to this agreement shall present this MOA to the Secretary of EOEA for acceptance.

EXECUTED as a sealed instrument as of the day and year first above written.

EOTC:

EXECUTIVE OFFICE OF TRANSPORTATION CONSTRUCTION

By:____________________________
James J. Kerasiotes
Secretary

MHD:

MASSACHUSETTS HIGHWAY DEPARTMENT

By:____________________________
Laurinda T. Bedingfield
Commissioner

____

____

____

____

MDC: METROPOLITAN DISTRICT COMMISSION

By: ______________________________
M. Ilyas Bhatti
Commissioner

By: Robert H. Camp
Associate Commissioner

By: ______________________________
Associate Commissioner

By: ______________________________
Associate Commissioner

By: ______________________________
Associate Commissioner

EXHIBIT A

The Commonwealth of Massachusetts
Metropolitan District Commission
M. Ilyas Bhatti, Commissioner

20 Somerset Street
Boston, MA 02108
617-727-5114

The Metropolitan Network of Services

Parks

Beaches

Community Boating

Historic Sites

Recreational Facilities

Public Concerts

Trailside Museum

ton Harbor Islands

Metropolitan Police

Flood Control

Watershed Management

Pure Water Supply

Quabbin, Wachusett and Sudbury Reservoirs

Franklin Park and Stone Memorial Zoos

Parkway, Boulevard and Bridge System

Charles, Mystic and Neponset Rivers

Beaver Brook, Blue Hills, Elm Bank, Breakheart, Middlesex Fells, and Brook Reservations

November 9, 1990

Mr. Anthony Fusco
Regional Administrator
Federal Highway Administration
55 Broadway, 10th Floor
Cambridge, Massachusetts 02142

Dear Mr. Fusco:

This letter is written to provide further clarification of determinations made by the Metropolitan District Commission ("MDC") regarding the park and recreational status of various areas in the Charles River Basin extension affected by the construction of the Central Artery/Third Harbor Tunnel ("CA/T"). This determination includes consideration of all changes that have occurred in this area of MDC jurisdiction since the approved 1985 EIS/R on the CA/T; these changes were described in MDC comments on the SDEIS/R dated August 27, 1990.

As I have stated on previous occasions (see letter dated September 24, 1990), the MDC is a multi-purpose agency providing a network of services for Metropolitan Boston including parks and reservations, police, flood control, watershed management and parkway systems. The Charles River Basin extension area was added to the MDC's jurisdictional authority in 1962. The Basin extension was created by the completion of a second dam in 1978, which was erected for flood control, water quality and fisheries restoration purposes, and which extended the Charles River Basin into a former tidal area. The dam and its associated locks are maintained and operated by the MDC, enabling navigation on the Charles River from Boston Harbor to the Upper Charles River, above the Museum of Science. Thus, the Charles River Basin extension (the Charles River between the two MDC dams) is managed by the MDC for multiple uses.

Also located in this Charles River Basin extension area are two major transportation crossings pre-dating MDC jurisdiction; (i) a railroad bridge, dating initially from 1835 and in its current form providing all commuter rail service connections to North Station; and (ii) the existing central Artery (I-93) bridge dating from 1955.

Since the approval of the CA/T EIS/R in 1986, there have been several significant MDC park land acquisitions along the river banks in the Basin extension, specifically the Nashua Street parcel, the Spaulding Hospital walkway, and the GSA parcel. These acquisitions represent a significant shift away from the previous industrial land uses in this area. When these parcels are developed into usable parks, together with the other proposed park improvements in this area (e.g., the proposed acquisition of private land adjoining the GSA parcel on the North Point Waterfront), a suitable setting for active recreational boating uses will be created. In addition, the substantial expanse of open river surface between the old dam and the MBTA bascule railroad bridge (the river here is 350 to 450 feet wide and over 1,150 feet from the dam to the railroad bridge) is sufficient to allow for a variety of

EXHIBIT A (continued)

recreational boating activities, without interfering with existing navigation by boats passing between the two dams via the railroad bridge draw.

These new GSA and Nashua Street parcels were specifically recognized by the MDC as the first step toward extending the Esplanade/Front park lands in its 1988 RFP for development of a master plan for the Basin extension. The MDC's planning objective has been to extend existing active water park uses found in the historic Charles River Basin (above the old dam) to below the old Science Park dam. The historic Charles River Basin can only be described today as a hub of recreational and sporting activity and has been acknowledged as a treasured water park, both in use and under statutory designation, for the past seventy-five years.

Based upon these changes over the past five years, the MDC has designated the portion of the Basin extension river surface area upstream of the railroad bridge, for park and recreational purposes. This water recreation area is administered as part of the Charles River Reservation. This facilitates active recreational boating uses in this area including sailing, use by small motor craft, offshore anchoring, fishing, and appropriately sited landings.

With respect to the portion of the Charles River surface located downstream of the railroad bridge in this multiple use area, the MDC recognizes that the potential for similar recreational uses is not present. This portion of the River is contained in useable width, and by the operation of pump intakes at the new dam. Boats waiting to pass through the twin bascule opening in the MBTA Bridge (which must be raised for passing boats, which therefore have long waiting periods during peak commuter rail hours), or through the locks (which can accommodate only limited number of boats at one time) are often queued in both directions in this area. Moreover a significant portion of the water surface near the north bank of Paul Revere Landing Park is restricted from use and is inappropriate for small boats because of water flow into the pump intakes. Although boat passage through this area is permitted, this is not a suitable location for active recreational boating and none currently exists there today due to these conditions. The downstream river area is also partially bordered by lands which are under the ownership of the transportation agencies, including the MBTA and the Department of Public Works.

MDC plans for use of this downstream river portion of the Basin extension include continuation of its existing navigation, flood control, and associated water management functions, along with transportation purposes, as the primary uses. The downstream water surface will also function as a connection or passageway for recreational boats traveling to the park areas upstream, in a manner analogous to the continuous pedestrian connection planned to link the various park nodes along the waterfront from Boston Harbor to the historic Charles River Reservation. While this navigational function is supportive of recreational uses, the primary use of the water surface itself downstream of the railroad bridge will not be recreational.

The Massachusetts Department of Public Works (MDPW) has also requested clarification of our position regarding the status of certain property located along the Charles River Basin extension known as the "CANA" construction site. These lands were acquired by the MDPW for purposes of constructing the highway connections at Routes I-93 and U.S. #1. They are presently owned by the MDPW and are the subject of a Chapter 91 license for the CANA construction. The proposed new crossing of the Charles River allows for greater uninterrupted expansion of Paul Revere Landing Park by removing the highway

EXHIBIT A (continued)

crossing to the west. This realignment effectively consolidates the transportation corridor in this area and significantly improves park opportunities, while also allowing for a continuous pedestrian pathway along the River's edge, located under the new bridges and over the railroad tracks. This is the realization of a long-standing MDC objective of connecting the historic Charles River Basin Esplanade park to the harbor. Nevertheless, the MDC recognizes that the lands in the CANA area which will after completion of the CA/T be located under highway structures or in highway infield areas, are a continuation of the transportation corridor across the downstream river surface and will continue to be used primarily for transportation purposes.

Pedestrian access along the river bank to the adjoining park nodes is compatible with such transportation uses. The expansion of Paul Revere Landing Park to the edge of the new highway crossing (described above), when developed after the completion of the CA/T project, will become an additional recreational area available for public enjoyment. Other specific landscaping improvements provided in the CANA Chapter 91 plans must be replaced with improvements of an equivalent nature in the CANA area or in the CA/T project area. In order to insure that these mitigation commitments will be implemented by the MDPW in conjunction with the CA/T project, the MDC will insist that the FSEIS/R and other regulatory documents and approvals include detailed plans providing for such improvements.

I hope this information is helpful. Please contact me if you require further clarification.

Sincerely,

M. Ilyas Bhatti
Commissioner

cc: John DeVillars

EXHIBIT B

Table 6.1
CONCEPTUAL IMPLEMENTATION SCHEDULE, NEW CHARLES RIVER BASIN MITIGATION PROGRAM

	Mitigation Measure	Prior To Construction	Construction Year.								
			1	2	3	4	5	6	7	8	
1.	Paul Revere Landing Park South										
1.1	Improve park						▨				
1.2	Improve corridor south to Causeway Street					▨					
1.3	Connect riverside walkway to south trestle walkway						▨				
1.4	Provide south bank railroad overpass for pedestrians/bicycles						▨				
2.	Lovejoy Wharf Park	◆									
2.1	Acquire wharf property	▨									
2.2	Demolish existing timber wharf and timber piles	▨									
2.3	Reconstruct wharf	▨									
2.4	Improve as park with walkway										
2.5	Provide Lovejoy Wharf/North End Park walkway underpass, with access to North Washington Street bridge	▨									
3.	Leverett Circle/Storrow Drive										
3.1	Improve greenspaces and edges							▨			
3.2	Provide appropriate architectural treatment to underpass and boat section facades			▨							
3.3	Provide new pedestrian overpass between Leverett Circle/Science Park MBTA Station and Nashua Street Park						▨				
4.	Paul Revere Landing Park North										
4.1	Improve park	▨									
4.2	Provide Tudor Wharf/Revere North walkway underpass	▨									
5.	Revere Park North, Westerly Extension						▨				
5.1	Construct walkway over MBTA railroad tracks to connect with North Point East Park							▨			
5.2	Improve park								▨		
5.3	Provide walkway from Rutherford Avenue to Charles River along east side Millers River										
5.4	Address Millers River stormwater draingage functions,as required						▨				
5.5	Construct walkways on either side of MBTA bascule bridge, north half								▨		
6.	Landscaping of Rutherford Avenue Infield	October, 1994									

◆ = Events
Source: Bechtel/Parsons Brinckerhoff

EXHIBIT B (continued)

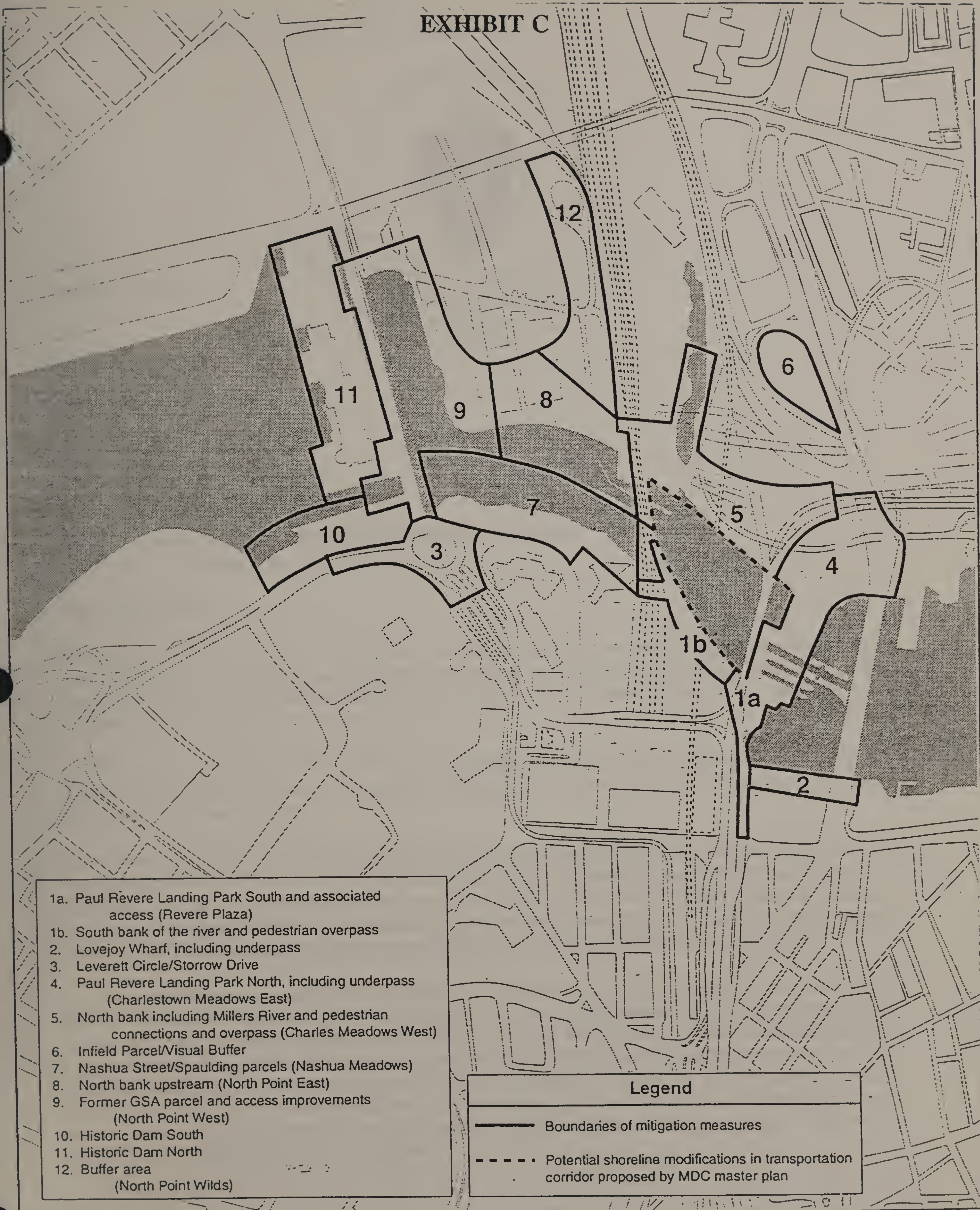
Table 6.1 (Continued)
CONCEPTUAL IMPLEMENTATION SCHEDULE, NEW CHARLES RIVER BASIN MITIGATION PROGRAM

Mitigation Measure	Prior To Construction	Construction Year. 1	2	3	4	5	6	7	8
7. Nashua Street Park									
7.1 Improve park	☐								☐
7.2 Improve waterfront portion of Spaulding Hospital site with minimum 100 foot depth	☐								
7.3 Rehabilitate shoreline as necessary									
7.4 Remove pilings from river, after consultation with owner	☐								
8 North Point East (park)									
8.1 Acquire land	◆ ▨								
8.2 Improve park	▨								
8.3 Remove existing railroad trestle at north riverbank, after consultation with owner									
8.4 Rehabilitate shoreline, as necessary	▨								
8.5 Remediate contaminated soils, as necessary	☐								
8.6 Provide new water feature with vegetated wetlands	☐								
9. North Point West (park)									
9.1 Acquire land for relocation of MDC central services facility	◆ ▨								
9.2 Construct new MDC central services facility	☐								
9.3 Demolish existing MDC central services facility	▨								
9.4 Remediate contaminated soils as necessary	▨								
9.5 Improve park	▨								
9.6 Provide new water feature, incorporating vegetated wetlands	▨								
9.7 Improve pedestrian access to North Point Park and Historic Dam North and South.	☐								
10. Historic Dam North									
10.1 Improve area and upgrade associated structures	▨								▨
11. Historic Dam South									
11.1 Improve area and upgrade associated structures	☐								▨
12. North Point Wilds									
12.1 Improve area									▨

◆ = Events

Source: Bechtel/Parsons Brinckerhoff

EXHIBIT C



1a. Paul Revere Landing Park South and associated access (Revere Plaza)
1b. South bank of the river and pedestrian overpass
2. Lovejoy Wharf, including underpass
3. Leverett Circle/Storrow Drive
4. Paul Revere Landing Park North, including underpass (Charlestown Meadows East)
5. North bank including Millers River and pedestrian connections and overpass (Charles Meadows West)
6. Infield Parcel/Visual Buffer
7. Nashua Street/Spaulding parcels (Nashua Meadows)
8. North bank upstream (North Point East)
9. Former GSA parcel and access improvements (North Point West)
10. Historic Dam South
11. Historic Dam North
12. Buffer area (North Point Wilds)

Legend

——— Boundaries of mitigation measures

- - - - Potential shoreline modifications in transportation corridor proposed by MDC master plan

FIGURE

4.17 Location of Mitigation Measures

Charles River Crossing FSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 800 FEET

January 21, 1994

Mr. Daniel Berman
Project Manager
Central Artery/Tunnel Project
Federal Highway Administration
55 Broadway, 10th Floor
Cambridge, MA 02142

Re: Central Artery Tunnel Project, Charles River Crossing
Boston, MA

Dear Mr. Berman:

Thank you for the opportunity to review the Draft Supplemental Environmental Impact Statement/Report for the Charles River Crossing and to consult with FHwA on the project team during preparation of the Final SEIS/R concerning potential effects of the Central Artery Tunnel project in the Area North of Causeway on historic and archaeological resources.

MHC's letter of December 9, 1993 addresses our specific review of relevant archeological surveys and concurs in the process outlined for ongoing archaeological coordination as the Charles River Crossing portion of the project proceeds.

With respect to potential historic and archaeological impacts more generally, the MHC concurs that the materials presented in Section 4.7 and the draft Section 4(f) evaluation in the DSEIS/R, as updated by additional materials the Massachusetts Highway Department has provided to MHC regarding proposed parkland and wetlands/waterways mitigation measures for the Charles River Crossing to be incorporated into the FSEIS/R, adequately describe potential effects on historic and archaeological resources.

In particular, MHC acknowledges the consultation by FHwA and the project regarding the Registry of Motor Vehicles Building, which was found eligible for listing in the National Register of Historic Places by the SHPO and the federal agency in 1988, and its proposed underpinning and the facade stabilization for construction of the Preferred Alternative, identified in the DSEIS/R and regarding the granite seawalls along the north bank of the Charles River which will potentially be affected by a replacement water feature now required for wetlands mitigation. Looking ahead, MHC is concerned that the building owner may in the future propose demolition of the Registry Building; Chapter 254 requires future consultation by DCPO, the building owner on this proposal.

Massachusetts Historical Commission, Judith B. McDonough, *Executive Director, State Historic Preservation Officer*
80 Boylston Street, Boston, Massachusetts 02116 (617) 727-8470
Office of the Secretary of State, Michael J. Connolly, *Secretary*

The MDC anticipates that the potential harm to historic and archaeological properties affected by the Charles River Crossing will be mitigated, as for the Central Artery/Tunnel Project as a whole, through the activities and programs included in the project's 1984 Memorandum of Agreement under Section 106 of the National Historic Preservation Act (36 CFR 800). The MOA stipulates project coordination with the project conservator, compliance with the joint development guideline process, archeological data recovery programs, and the recordation of historic properties to HABS/HAER standards. The Massachusetts Historical Commission looks forward to continued consultation with your agency under these provisions.

These comments are provided to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), Massachusetts General Laws, Chapter 9 Sec. 26-27c, as amended by Chapter 254 of the Acts of 1988 (950CMR 71.00), and MEPA.

If you have any questions concerning these comments, please feel free to contact me, Brona Simon, Deputy SHPO and State Archaeologist, or Allen Johnson, Director of Architectural Review at this office.

Sincerely,

Judith B. McDonough

Judith B. McDonough
Executive Director
Massachusetts Historical Commission
State Historic Preservation Officer

cc:
- Boston Landmarks Commission
- Cambridge Historical Commission
- Boston Preservation Alliance
- National Trust for Historic Preservation
- Peter Zuk, MHD
- MEPA Unit, EOEA

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